THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LXV. No. 1667.] LONDON, APRIL 23, 1895. [47TH YEAR. PRICE 6d.

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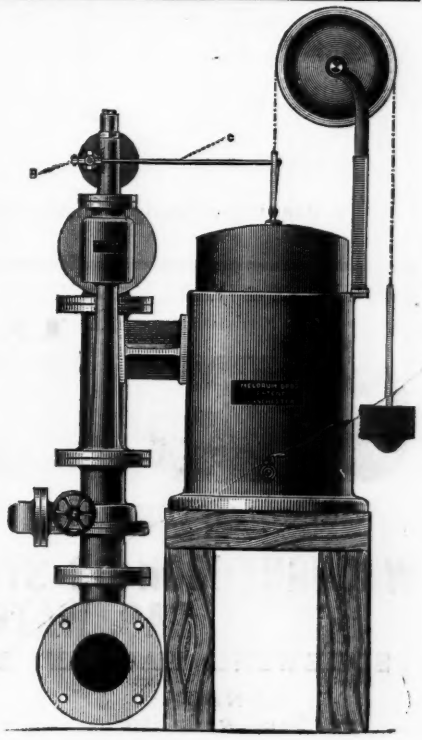

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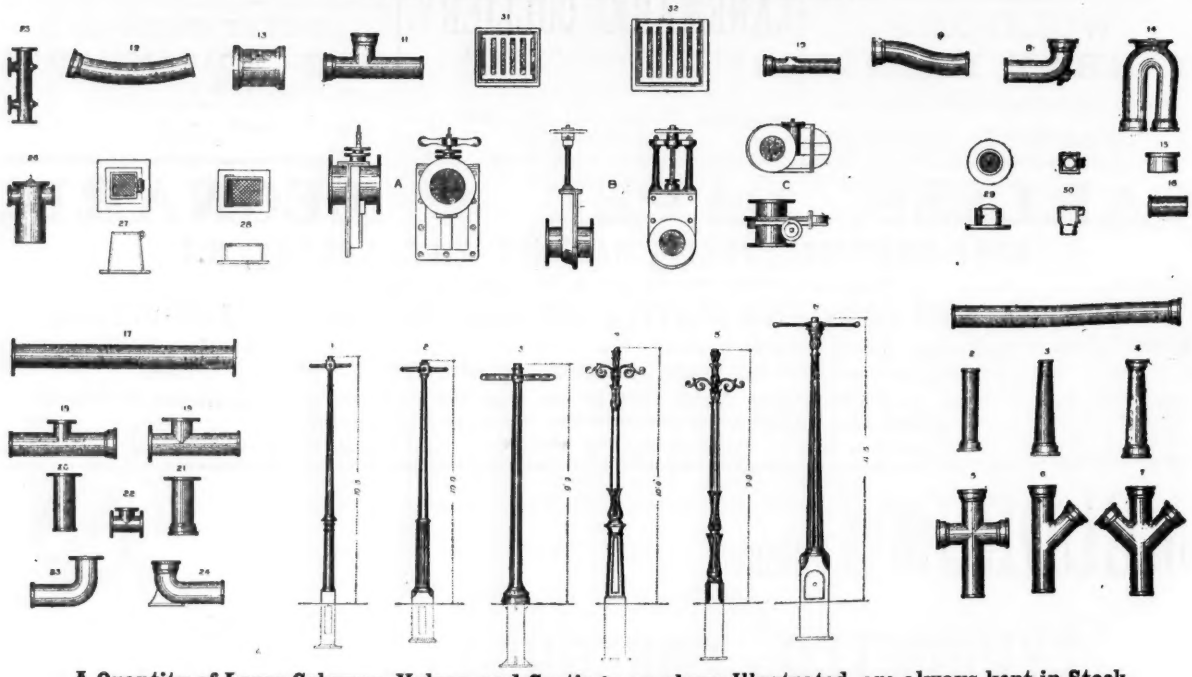

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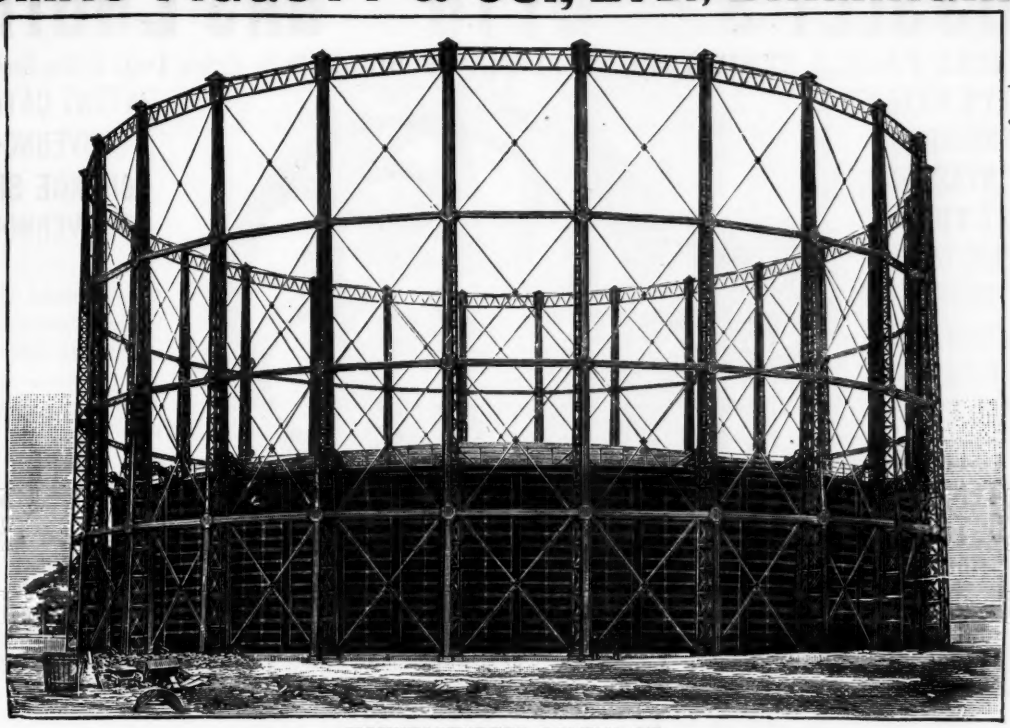

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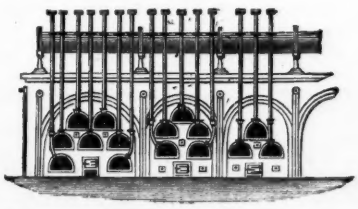

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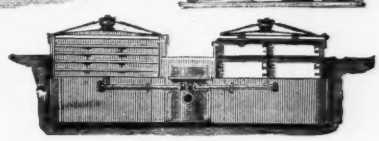

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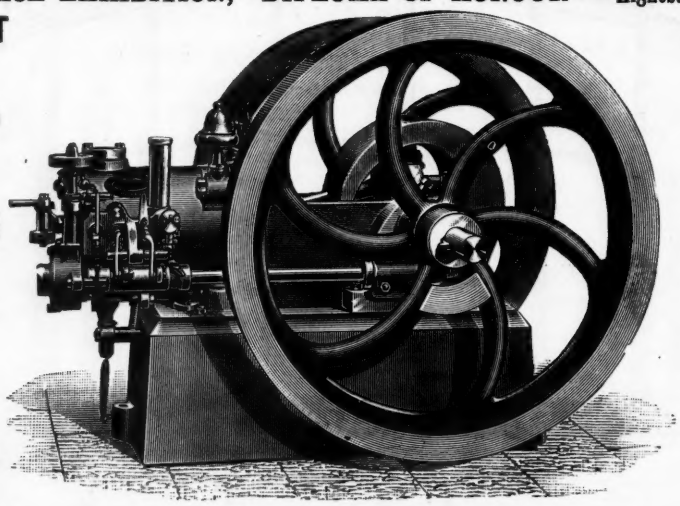

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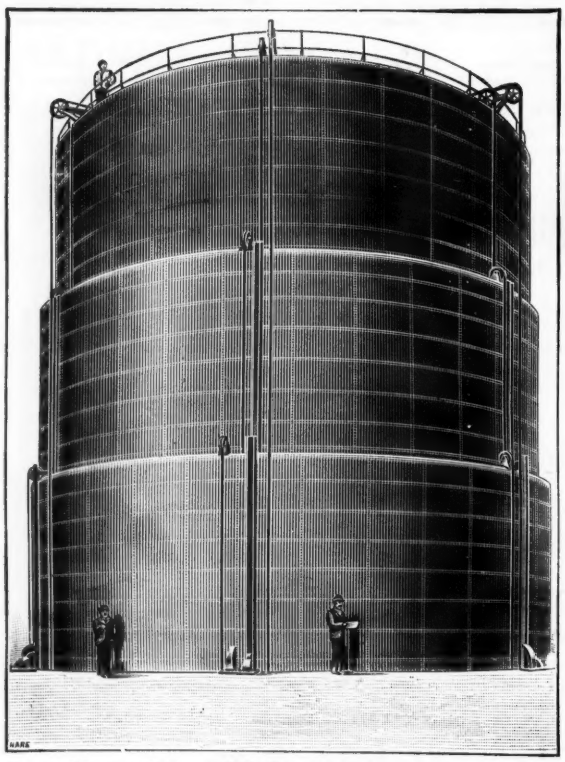

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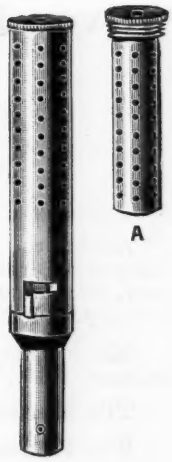

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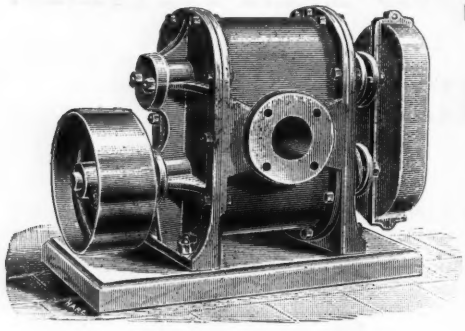

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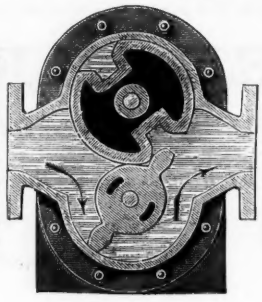

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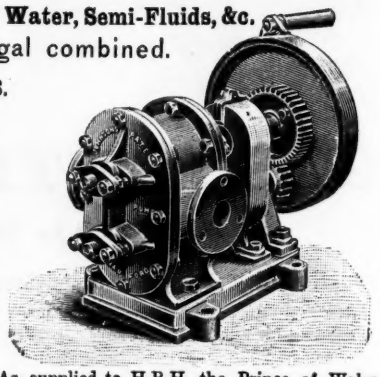

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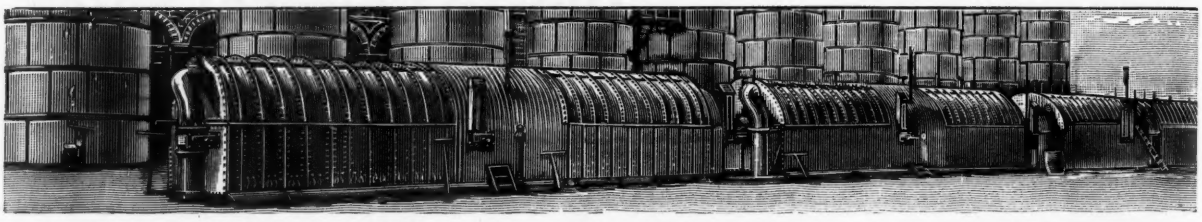

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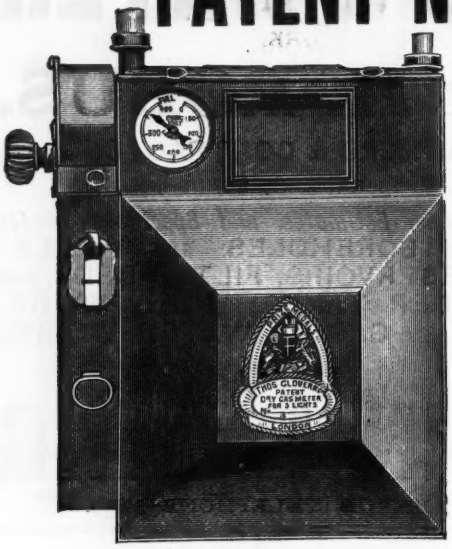

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[See also Advt. p. 876

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TO CORRESPONDENTS.

No notice can be taken of anonymous communications. Whatever is intended for insertion must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

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EDITORIAL NOTES.

Analysis of the Metropolitan Gas Accounts for 1894.

IN the present issue of the JOURNAL (p. 843), we give our usual abstract of the accounts of the Metropolitan Gas Companies for the past year. The capital, including loans, engaged in the supply of gas to the districts covered by the three Companies, amounted by the end of the year to £16,439,149, which was an increase for the year of £113,482—all taken by the South Metropolitan Company. By the employment of this capital, a gross income of £5,176,169 was earned, for an expenditure upon revenue account of £3,473,175; leaving a gross profit of £1,702,993, which works out to £10 7s. 3d. per cent. upon the total capital. At a rough calculation, the figure that has been mentioned several times of late in public discussions as to the purchase value of the Metropolitan gas undertakings—about fifty-one millions sterling—is, therefore, not far from the mark, as indicated by these totals. A good idea of the scale upon which the Metropolitan Gas Supply business is worked is obtainable from the third tabular statement, which shows the increases and decreases upon the different items of the accounts for the year. Hereby it will be seen that London paid on the whole less for its gas by £66,983 than the same commodity cost in 1893; the decrease being accounted for by the substantial reductions of price in every district, which is a consideration not apparent from our tables. The growth of business is shown by the increase of £7895 in meter and stove rentals. With another year, this means of indicating the course of trade will not be available, owing to the cessation of the charge for meter-rents in the Chartered district. The improvement in the value of residuals added £130,213 to the Companies' income; the benefit being fairly distributed among all of them. Upon the side of expenditure on revenue account, the drop in the value of coals saved the Companies £116,053, notwithstanding the fact that a heavy increase of consumption in at least two of the districts had to be provided for. Purification was a growing item; but salaries and wages for gas manufacture decreased by a small, though positive, amount—the greatest economy under this head being exhibited (wonderful to relate) by the South Metropolitan Company, notwithstanding the greater output of gas and the charge for the profit-sharing scheme. Rents, rates, and taxes were swelled by £15,864. Altogether, the cost of gas making and distribution was less by £75,450 than the expenses of 1893.

When we come to the middle table, which is usually highly instructive, we are met with the difficulty of the disturbing element introduced into all recent Metropolitan gas statistics by the unknown quantity representing the influence of the oil and petroleum spirit used, in different proportions and in different ways, by the Companies. We have endeavoured to establish a firm basis for our ratios for 1894 by reducing all the liquid hydrocarbons of which there is any account to an equivalent in weight, which is added to the weight of coal and cannel carbonized. This being understood, it will be perceived that, while we have secured some sort of common datum with reference to which the figures applying to the working of the Companies may be compared for the single year, any comparisons of some of the items with the corresponding figures of previous years will be subject to a certain, though small, correction. For the year 1894, it is shown that the capital employed by the Companies was: For the Chartered Company, £6 7s. 10·34d. per ton of gas-making material carbonized; for the South Metropolitan, £4 11s. 1·42d.; and for the Commercial, £4 1s. 7·23d. Five years ago the figures were: Chartered, £5 13s. 11·96d.; South Metropolitan, £4 14s. 8·56d; Commercial, £4 0s. 10·86d. In the last quinquennium, therefore, the movement has resulted, for the Chartered, in a heavier capital burden of 13s. 10·38d. per ton; for the South Metropolitan a decrease of 3s. 7·14d. per ton; for the Commercial Company, the small increase of 8·37d. per ton. This is by far the most important lesson of the table—what it means is not for us to say. Another interesting figure is the proportionate cost of carbonized material. Five years ago, the Chartered Company paid 12s. 0·73d. per ton for coal and oil; the Commercial, 11s. 11·79d. per ton; the South Metropolitan, 11s. 4·43d. per ton. At this period, the Chartered Company had not discontinued the supply of cannel gas. Last year the Chartered Company paid for coal and oil 11s. 5·94d. a ton;

the Commercial, 11s. 9·80d.; and the South Metropolitan, 10s. 6·56d. Then comes the greatly-debated item of the cost of carbonizing labour, which stands for the Chartered Company at 3s. 7·93d. per ton; for the Commercial, at 3s. 9·57d. per ton; and for the South Metropolitan (including profit-sharing), at 2s. 10·90d. per ton. As to this item, it must be borne in mind that the Chartered Company have a considerable make of carburetted water gas, which costs comparatively little for labour; while both this Company and the South Metropolitan Company go in largely for labour-saving machinery. Both the Chartered and the Commercial gas, however, is still made under the auspices of the Gas-Workers' Union. Five years ago, when the eight-hour shift had been adopted during half the year, carbonizing wages cost the Chartered Company 3s. 3·20d. per ton of coal carbonized; the Commercial, 3s. 3·94d. per ton; and the South Metropolitan (where the working staff had been largely changed by the strike of December), 3s. 7·54d. per ton. If we go back another five years, to eliminate all disturbance due to labour troubles, and return to the state of things prevailing under the double shift, we shall find the Chartered Company paying, in 1884, after the rate of 2s. 11·38d. per ton of coal carbonized; the Commercial, 3s. 4·33d.; and the South Metropolitan, 3s. 0·27d. per ton. The perfectly astonishing result is thus established beyond cavil, that the South Metropolitan Company, while paying the same rates of wages and giving a share of the profits in addition, are actually making gas at a cost for labour, of from 9·03d. to 10·67d. per ton less than their neighbours, and at a saving of 1·37d. per ton upon the charge at the period when eight-hour shifts, strikes, and profit-sharing were yet hidden in the future. After this, there is nothing more to be said of these tables that would not be tame and flat reading.

TABLE *showing the Residuals produced per Ton of Coal and Cannel, and the Gas made per Ton of Coal, Cannel, and Oil, by the Metropolitan Gas Companies in the Year* 1894.

Name of Company.	Coke.	Breeze.	Tar.	Ammoniacal Liquor.	Gas.
	Cwt.	Bushels.	Gallons.	Gallons.	Cub. Ft.
CHARTERED . . .	12·31	3·31	10·22	31·00	10,221
COMMERCIAL . . .	12·15	4·78	10·01	35·45	10,095
SOUTH METROPOLITAN	12·32	3·87	9·87	34·63	10,136
Mean per Ton . .	12·30	3·57	10·11	32·31	10,189

The small table which appears above speaks for itself. The figures are, of course, peculiarly affected by the different carburetting arrangements in operation during the year at the various works. They prove, at any rate, that the Companies do not get more gas to the ton out of their miscellaneous raw materials than was registered when there was a more restricted choice in this regard. Indeed, as compared with the makes of gas of a few years ago, those of last year exhibit a marked diminution.

Colonel Makins on the "Workman-Director" Question.

IT is not our intention to follow Colonel Makins through every sentence of his last letter, which appears in our "Correspondence" columns to-day; especially as some of his points are anticipated by other matter which we publish elsewhere relating to experience gained in the working of what he now styles "the wild scheme of hermaphro-"ditic representation." Colonel Makins may indulge his fancy for "a nice derangement of epitaphs" to the top of his bent; but he will never succeed in proving that the principles of co-operative production, with direct participation by workers in the administration, which have been applied in all kinds of industries in every part of the country, cannot be extended to the gas industry. All he does prove is that he personally does not like the idea; but this is already made clear. Colonel Makins may consider, if he chooses, that any of his observations which are not answered are therefore unanswerable. But, really, we want to make the controversy move on a little, if possible; and in this Colonel Makins does not help us. All that is needful to be said about Mr. Livesey's way of bringing on the question of workman-directorships has moreover been said more than once; and no further discussion of this particular manifestation of the idiosyncrasy of the South Metropolitan Chairman can serve any other purpose than that of burying the real question under superfluous personalities.

Divested of mere repeated statements of individual opinions and objections to Mr. Livesey's remarks and proceedings, Colonel Makins's letter contains little besides a protest against the "one-man power" in the working of companies; a sort of apology for Trades Unionism; and the important declaration of the postscript that, in the writer's view, it is part of the duty of directors of statutory companies to resist everything savouring of constitutional change. There is little reason to fear that the last-mentioned view of the duty of a director will ever fail to commend itself to the judgment of many gentlemen of the directorial persuasion. To "mark time" at so much a meeting is surely too comfortable and profitable an occupation to be readily abandoned by those who have once got into the way of it. Yet, marvellous as it may appear in the eyes of Colonel Makins and his like, there are people in the world who are anything but content with the existing directorial system of joint-stock company management; who hold that the theoretical amenability of directors to shareholders is a mere fiction; and who would welcome almost any promising suggestion for improvement in company administration. We refrain from pointing the argument by reference to Chartered experiences; but Colonel Makins's contention that directors should never move out of their rut is tantamount to admitting that all reform of the joint-stock trading system must come from without—that is, from innovators without experience of the inner working of the system. We should be sorry to accept this as the correct view of the subject.

As to the "one-man power" in company management, it is enough to say that, notwithstanding the discredit into which "Watkinism" has deservedly fallen, companies can no more move ahead without the propelling force of individual initiative than an army can march without a general. Call him chairman, general manager, engineer, secretary, or what one will, there is always in a live industrial organization a live man who supplies the motive power. There are plenty of such organizations which have no such motor at some particular period of their existence. But then they do not progress. Sometimes they die out altogether; but if there is the fly-wheel of a big capital and reliable connection, amounting to a sort of monopoly, to keep them going, they frequently drag on a routine existence which can only be distinguished from real life by expert diagnosis. Colonel Makins speaks of his railway experience; and we will confine ourselves to railway illustrations of our meaning. What was the Great Eastern Company like before Lord Cecil (now the Marquis of Salisbury) was put at its head? For how long a period was the Great Western Company in a state of suspended animation, before Sir Daniel Gooch was sent for? What constitutes the difference between the London and South-Western Company of (say) twenty years ago and of to-day? Similar questions might be multiplied almost to infinity with relation to all sorts of undertakings. The real objection to "Watkinism" was Watkin—it is quite unnecessary to say more. Consultative Boards are all very well so far as they go; and if, with the multitude of such mercantile counsellors, there is not always wisdom, with a plenitude of honest and watchful trustees there is at least a prospect of financial rectitude. But initiative is inalienable from the individual. If Colonel Makins will undertake to prove that initiative is never needed in the conduct of the gas industry, he will eliminate the need for the individual, who is very often a troublesome person, refusing to keep quiet.

It is a remarkable illustration of the straits to which a controversialist is sometimes brought, when one finds the Governor of The Gaslight and Coke Company declaring that he does "not consider Trades Unionism such a "terrible monster that it should be coaxed or bribed out "of existence." If Colonel Makins and some of his co-Directors would only carry their minds back to the winter of 1889, they could hardly express their thoughts of Trades Unionism thus. Naturally, strikes—at other works—proved in some respects a blessing in disguise to the Chartered Company. But there certainly was a time when Colonel Makins himself talked of buying over the goodwill of the employees of the Company by the institution of some sort of bonus scheme, which was to effect all the good of the South Metropolitan profit-sharing plan without its disadvantages—one of which, by the way, was declared to be that of carrying with it "a right of partner-"ship in the management of the Company." The whole passage occurs in the Governor's speech at the Chartered

meeting of Feb. 7, 1890, as reported in the JOURNAL at the time (see Vol. LV., p. 247). However, other times, other manners. Cerberus no longer appears to need a sop; wherefore the Governor is in no hurry to throw him one—so long as he will sleep in peace.

Settlement of the Boot-Strike.

THE satisfactory announcement was promulgated on Saturday that the mediatory efforts of Sir Courtenay Boyle, of the Board of Trade, in regard to the strike and lock-out of boot-makers, had been successful in procuring the adhesion of the representatives of the employers and the employed to a scheme of settlement calculated to restore peace to the industry. Of course, the result is hailed in some quarters as "a great victory for Trades Unionism." If to gain a victory consists in sacrificing all one's resources in conducting a struggle which need never have been entered upon, and in the event accepting terms of settlement which might have been had from the first for the asking, then the National Union of Boot and Shoe Operatives have undoubtedly been victorious on the present occasion. The employers, however, who have gained by the conflict all for which they were really contending, are not likely to begrudge to their late adversaries the empty vaunt of having "saved the Union," which would have gone to pieces in another week or two. Great credit is due to Sir Courtenay Boyle for the tact and power which he has displayed in rendering the settlement possible; and it is of good augury for a prolonged peace that the management of this difficult business was given, by common consent, to a public servant of distinction, whose motives were above question, and was not left to any of the scheming politicians who at an early stage of the dispute sought to "boss" the whole thing on their own account. The great principles of freedom of control and of mastery in their own business have been secured by the employers; and thereby the English boot-trade is saved from perishing under the blighting influence of the "union stroke." Arrangements have been concluded for the establishment of Arbitration Boards for disposing of such questions of work and wages as may be fittingly left to impartial arbitrament; and safeguards have been agreed to for the protection of employers and employed from capricious alterations of the conditions of labour. Questions of control, however, are not only withheld from the proposed Arbitration Boards, but are not to be made matters of dispute by the Union.

A highly important and most interesting feature of the settlement is the step that has been taken towards the desirable object of making arbitration awards binding upon the parties. There have been Arbitration Boards and Arbitrators before to-day in connection with the staple industry of Leicester and Northampton. But these fell into disrepute because the men never submitted to an adverse decision. Now an attempt is to be made to put a stop to this mischief. Sir Henry James is to draw up terms for a trust, into which both masters and men are to pay so much caution-money, to be devoted (if necessary) to the enforcing of the Arbitrators' decisions. No strike or lock-out is to be entered into by any body of workmen or employers represented upon any Arbitration Board. Any Unions so represented are to expel members who disobey the award of a Board—which is the nearest approach that has yet been made towards rendering these organizations responsible for the actions of their members. It will be interesting to see how the settlement will work. It may at least be said that, under it, the Unions will be able to show whether they are competent to fulfil the objects which they profess to subserve, of protecting their members, while offering to the employers a means of negotiating with a really responsible trade organization. Nobody ever objected to trade societies that confined themselves to these useful and perfectly legal offices. It is when Unions set themselves in opposition to machinery, endeavour to impose restrictions upon the liberty of the subject, or lend themselves to the perpetration of acts of violence and rapine, that they become noxious excrescences upon a trade, which must be cut off if the industry is not to be killed by them. Meanwhile, Leicester is to be heartily congratulated upon being well to the fore in the organization of industry on truly progressive lines.

The High Price of Petroleum.

PUBLIC interest has been aroused for some time past in regard to the vagaries of the American petroleum market; and during the last week or two everybody has been asking everybody else why lamp-oil has been run up to double its usual price, just when the heaviest demand for it might be supposed to be over for the season. Nobody has been able to satisfactorily answer the question. Some have accused the Standard Oil Company of establishing a "corner" in oil; but this could only be possible by co-operation with the Russian producers. Others have said the Standard Oil Company are themselves the sufferers from a combination of recalcitrant refiners, tired of sending all their output into the Company's pipe-lines and getting in return only whatever price the Company chose to pay them. The yield of the Pennsylvanian wells has been reported to be failing; and it has been stated that the rise is nothing more than the last flare-up of the dying lamp of the American oil-trade. Meanwhile the Scottish shale-oil producers have been looking after themselves, in the manner that was to have been expected of them; and the Russians have followed suit. The question for our readers is, of course, what is to be the effect of all this on carburetted water-gas processes? We do not think the effect likely to be great, or permanent. Most of the oil required for gas-making purposes in the United Kingdom has been contracted for upon such terms, and for such periods, as are calculated to make the purchasers congratulate themselves; and, in any case, the manufacture of carburetted water-gas is not yet necessary to life in this country. If oil for gas-making is to be dear, British gas manufacturers will leave it to those who are willing to buy it at the price. But the prevailing impression is that prices are bound to fall again to the old level—possibly below it—which does not, however, explain why they should have jumped so high above it. It is not putting the case too strongly to say that a month or two ago the possibility of a "boom" in (say) road metal would have been regarded as quite as likely as a similar movement in petroleum.

Death of Mr. Robinson Latter.—We regret to announce the death, on the 11th inst., in his 76th year, of Mr. Robinson Latter, the Chairman of the Bromley (Kent) Gas Consumers' Company. The sad event occurred quite unexpectedly, at his residence, Pixfield, Bromley; deceased having only on the previous day attended a Board meeting. Mr. Latter's position in the Company was unique. He was one of the promoters of the undertaking in 1854, and since 1856 had been Chairman. His sterling worth and great business capacity combined with local knowledge, to which few could lay claim, were invaluable; and it is not too much to say that the Company's prosperity is largely the result of his intelligent and enlightened policy, and the untiring interest he took in all its affairs. As showing the advance made during the period covered by his chairmanship, it may be mentioned that in 1856, with gas at 7s. 6d. per 1000 cubic feet, the total rental was less than £800; while last year, with gas at 3s., the rental was nearly £28,000. At the former period, a small portion only of the town was lighted; whereas now the area of supply extends throughout the whole of Bromley and the adjoining parishes comprised in the Company's district. The large and representative gathering at the funeral bore eloquent testimony to the high esteem and affection in which deceased was held by all classes of the community.

A Testimonial for Mr. Joseph Hepworth.—Before Mr. Hepworth severs his long and useful connection with Carlisle, the citizens have resolved to recognize, in some tangible form, the valuable services which he has rendered to them in the capacity of Gas and Water Works Engineer. In order to discuss the steps to be taken in the matter, a public meeting has been held, at which the Mayor presided; being supported by many of the leading men of the city. His Worship, in opening the proceedings, bore testimony to the admirable work Mr. Hepworth had accomplished in Carlisle; and he specially pointed to the fact that when he entered on his duties 25 years ago, the gas-works were not in the excellent condition which they now present—indeed, he described them as "model works." In the period mentioned, the production of gas had risen from 80 million cubic feet to 240 millions. He was extremely sorry that they were parting with such a worthy official, who, in going away from Carlisle, would not leave one enemy behind him. He had managed their works in such a manner that few would be able to follow in his footsteps. Several other speeches were made, all of them extolling Mr. Hepworth's work. The first resolution passed was: "That this meeting is of opinion that the valuable services to the citizens of the city of Carlisle by Mr. Joseph Hepworth, M.Inst.C.E., in the capacity of Gas and Water Works Manager during the past 25 years should be recognized by a testimonial; and that the public be invited to subscribe any sum not exceeding £2 2s. each for that purpose." A Committee was also appointed; and the Mayor was selected to undertake the duties of Treasurer of the fund.

WATER AND SANITARY AFFAIRS.

It is a little odd that, at the last meeting of the London County Council before the Easter recess, a report was presented by the Parliamentary Committee, bearing the date of the 4th inst., giving an account of a conference between a Special Sub-Committee of the Council and the County Purposes Committee of the City Corporation; such conference taking place as far back as Feb. 28. At that conference, the following resolution, among others, was passed: "That it be represented to the London County "Council and the Corporation that, in the view of those "taking part in this conference, the City should have, in "a complete water scheme for London, such share of the "management as is contained in the London Water Bill "of 1892." A resolution of this kind was in accordance with the compact entered into between the Corporation and the Council at the time when the Bill of 1892 was in a somewhat critical position. Such was then the nature of the situation that it rested with the Corporation whether the Bill should be proceeded with, or whether it should be dropped. In reality, the Corporation had no reason to care for the further progress of the Bill; their interest in it having ceased, owing to the decision come to by the Select Committee of the House of Commons, eliminating the Statutory Committee on which the Corporation were to be represented to the extent of one-eighth of the members placed upon it. The County Council had no power to promote a Bill dealing with the water question, whereas the Corporation had funds available for the purpose. Why should the Corporation find money to enable the County Council to fight the Water Companies? The Corporation saw fit to go on; and the Bill having become law, *minus* the Corporation and the Statutory Committee, the County Council have been enabled to promote Water Bills at their own instance. The fruit is seen in the bringing forward of the eight Bills for the "transfer" of the undertakings of the Metropolitan Water Companies; the Corporation being left out. The civic authorities are indignant; but they need not be surprised. The County Council have lately relented, or have thought it wise to make things pleasant; and now, at the eleventh hour, they have passed a resolution that in "the future Water Com-"mittee," the Corporation shall have a representation of one-eighth, "upon the basis and terms set forth in the "deposited Bill of 1892, entitled the London Water (No. 1) "Bill." But now there comes up a petition to Parliament from the Corporation, in opposition to the entire scheme; the forefront of the petition setting forth the breach of faith on the part of the County Council in making no provision for carrying out the agreement of 1891, on which the Bill of 1892 was framed.

If the petition of the Corporation went no further than this, the resolution adopted by the Council a fortnight ago might settle the whole affair. But the civic petition goes very much farther, and cites against the present Water Bills a number of objections which are weighty and valid, showing that the Council are seeking to work out the scheme after a fashion which the Corporation failed to apprehend three or four years ago. The petition states that "the agreed Bill" provided, as far as practicable, for placing that portion of the water supply of London which is situated outside the boundary of the county, in the hands of the local authority of each district. The Corporation therefore submit that the Authorities of the outer areas, as well as of the City, should be represented on "the new authority to whom the carrying out of any "purchase may be entrusted." This, it will be observed, puts the new authority between the Council and the purchase. After the purchase is effected, the same system of representation is to be continued for the management and control of the undertakings. It may be remembered that the Statutory Committee to which the Select Committee of 1892 objected, was to be a Committee of the County Council, although having representatives on it from the Corporation. The petition puts forth a broader view of the question; and it is contended that, having regard to the work already undertaken by the County Council, that body would not be equal to "the "further task of purchasing, managing, and controlling "the water supply of London." This would seem to be setting the County Council aside altogether, and creating literally a new authority, composed of representatives from the Council, the Corporation, and the outer areas.

It is to be noted that the Corporation always had respect for the outer areas; and it is in regard to this element that the County Council plan is defective. The Water Bills provide that the Council and the Local Authority of an outer area may enter into an agreement for the sale or transfer to the latter of the works connected with the local supply. Or the undertaking may be leased, or a supply may be given in bulk. But the civic petition asks that the Local Authorities outside the Metropolis may be able to acquire, "direct from the Water Companies," such part of the undertakings as are not actually required for the purposes of the water supply of the Metropolis. This, however, forms no part of the County Council scheme. The Council is to obtain possession of the whole water supply, inside and outside the County of London, by March 31 next, or such other date as may be agreed upon between the Council and each Company. If the price has not become a matter of agreement (a tolerably certain issue), the terms are to be settled afterwards by arbitration; the actual process being of the extraordinary kind to which we have previously invited attention. The Corporation see great objections to all this; yet the procedure is substantially what they might have looked for. They say that the general provisions of the Bills "are not fair or reasonable, either to the Companies or the "consumers, and must, if acted upon, lead to hopeless "confusion and dissension." Until it is too late to put matters right, the Companies will not know what they are to receive, nor the ratepayer or the consumer what he will have to pay. Should the Council be in want of money, they will have it in their power to "enormously increase "the water-rates," both in and out of London. Such are some of the considerations embodied in the protest of the Corporation against the water schemes of the County Council. The general terms of the petition are quite consistent with what we find in the report of the County Purposes Committee presented to the Corporation in the autumn of 1890, at the close of the inquiry presided over by Sir W. Guyer Hunter, in which report the latter concurred. One sentence in the report may be taken as a key to the rest. The Committee say they have no hesitation in recommending that the Corporation should suggest to Parliament "a representation of the areas as the most "effectual way of governing the watershed and managing "the supply." The mode proposed in the report for dealing with the Water Companies is also in marked contrast to the despotic designs now disclosed by the Council. The Corporation have acted wisely in coming forward to petition against a project so materially at variance with their original intentions, although they are in some degree responsible for its existence.

In the midst of all this contention as to who shall have possession of the water supply, what shall be paid for it, and where it shall come from, a very sensible letter from Mr. Walter Hunter appears in the columns of *The Times*, calling attention to the exaggerated nature of the schemes promoted or contemplated by the County Council. That body professes its intention to bring in a supply from a distant source, the estimate for which is £20,000,000, with the probability—judging by the experience of Liverpool and Birmingham—that the cost will be £30,000,000. Yet the same quantity of good water can be obtained from the Thames and Lea, at an expenditure of about £5,500,000. So far as relates to the Thames, Mr. Hunter is, of course, referring to the Staines scheme, devised by himself and Mr. Fraser, and spoken of approvingly by the Royal Commissioners. The works undertaken by the Southwark and Vauxhall Company may be looked upon as an instalment of that project, although coming a little lower down the river. The extension of the East London reservoirs is also in hand; and there is no doubt that the growing wants of London both can and will be effectually met in accordance with the growth of the population. This will be at the cost of the Water Companies; and Sir John Lubbock has discreetly advised that the burden should be allowed to rest in that quarter. With provision for due control, by the nomination of representatives in the public interest on the Boards of Directors, as suggested by Sir John in the letter we published last week, there would be a perfect guarantee of efficiency, without casting any additional charge on the consumer or the ratepayer.

To a corporate body whose consuming desire it is to wrest a water undertaking from a local company, it must be extremely annoying to find that the company are free

from sins of omission or commission, or, in other words, that there is "no case for the prosecution." This seems to be the unhappy position of the Portsmouth Corporation at the present time. Long years ago, the Corporation exhibited a hankering after the Portsmouth Company's works. Negotiations for purchase were set on foot, and came to nothing. Then, after an interval, during which the value of the Company's property had become largely enhanced, the subject was revived, only to lapse once more. Of late, however, the Local Authority have again taken up arms; and, being anxious to acquire the works, they adopted the too familiar method of trying to find fault with the management, or the rates, or anything else that was handy. The result has been the entire collapse of the critics. Their accusations were formulated, and may have worn a formidable aspect; but when tested by the actual facts, and the rates charged in other towns where the supply is not in the hands of a public body, it became manifest that the Portsmouth Company were absolutely free from just reproach. In a well-considered and exhaustive statement, published in the local papers, the Directors (speaking through their Secretary) have completely disposed of the indictment which the Corporation put forward. Of course, the worthy Aldermen and Councillors do not regard the communication as quite convincing. When one wants to prove a case, it is never satisfactory to be met with a complete and conclusive defence; and that is just what has happened at Portsmouth. The truth is that the Local Authority have been nibbling long enough. If they want to buy, they should manfully face the situation, and be prepared to pay that ample price which the prosperous and successful character of the Company renders just. If they are not prepared to buy, there should be an end to these petty and spasmodic attempts to harass the property and cheapen a really valuable undertaking.

The recent decision of Judge Bagshawe (in the Brentford County Court) in an action brought by a consumer against the Grand Junction Water-Works Company, is of importance to Water Companies in general, although the ruling involves no new legal doctrine. The plaintiff had paid the Company too much; and why? Not by reason of any misrepresentation or misstatement on the Company's part, but because he himself had failed to notify the reduction of the assessment on his house which governed the amount of the water-rate. It was not shown, and it could not be shown, that the Company had knowingly and intentionally made an overcharge. The mistake, the learned Judge held, was one of opinion and of estimate, rather than one of fact. But, at any rate, the plaintiff knew, or might have known, as much as defendants did as to the rating of the house in his own occupation. Water consumers are reasonably expected to look closely after their own interests in such a matter; and they already manifest a sufficiently litigious spirit without needing the further encouragement which a decision in the plaintiff's favour would certainly have afforded. It is sometimes a wise policy of the law to "let sleeping dogs lie." Where there has been no fraud, and money has been paid and received under a *bonâ fide* mistake as to the facts governing the payment, the money erroneously paid must stay where it is. The principle has been again and again affirmed by the Courts; and in regard to the ordinary affairs of life, no lawyer would dream of contesting the position. But in these days, any "stick" is deemed good enough, in a water consumer's eyes, to beat a company with; and hence, probably, the recent attempt to coerce the Grand Junction Company. Probably under ordinary circumstances, a water company might be quite willing to refund even where—a mistake being shown—the law gave them protection. But prudent directors must necessarily guard against concessions which would lead to wholesale demands, or attempted demands, of a similar character. Their legal position in such circumstances is impregnable. If money paid under mistake of fact is irrecoverable, there is still stronger ground for holding, as Judge Bagshawe did, that the law affords the same protection where there has merely been an error in the nature of an opinion or estimate.

Another Handsome Bequest.—Mr. George Henry Strutt, J.P., of Belper, who died last Sunday week, has instructed his executors to transfer to the District Council (of which he was Chairman) the sum of £11,700 for their absolute use in improving the water supply.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 863.)

When the Stock Exchange opened last Tuesday after the Easter interval, the markets in general wore a cheerful appearance, and prices seemed inclined to rise freely. There was thus good promise of a favourable week. But the pace was too good to last; and things soon slackened off considerably, with a dull tendency pretty well all round. From that point, they continued irregular, but without much disposition to mend. There was no strong depressing influence at work; but some uneasiness was felt lest the re-establishment of peace in the East should be followed by difficulties between interested Western powers. The Money Market is extremely quiet; and rates rule very low. Business in the Gas Market has been below the average volume, and not of much importance. By way of a change, movements in quotations were quite as much down as up; the two biggest issues showing a slight falling off. The general strength, however, remains unimpaired, and should do so; seeing that gas companies (at all events in this country) are doing very good business, despite the condition of the markets for some of their residuals. In Gaslights, the "A" was a little irregular—opening at 268, and then falling a couple of points, but finally recovering to the opening price. The quotation, however, was left at the reduced figure. Very little was done in the secured issues; but higher prices were realized, and the 4 per cent. debenture rose a point. Nothing was done in South Metropolitans, beyond a few transactions in the "B," all of which were at very good figures. A few bargains were marked in Commercial old, which was very firm. In the Suburban and Provincial division, there was very little animation; but prices were excellent, although Bristol (which had been put up a little too sharply) was brought back a point. Business in the Continentals was confined to Imperial, which was slightly weaker, although the prices at which transactions were marked did not show much difference. Of the more remote undertakings, Ottoman showed an advance; while Bombay and Buenos Ayres were in some request. Business in the Water Companies was extremely restricted; and the chief feature was the continued reaction in favour of the debenture stock issues.

The daily operations were: Business was very slack and sluggish on Tuesday, the opening day; and the only move in Gas was a rise of 1 in Gaslight 4 per cent. debenture. In Water, East London debenture rose 4. There were more transactions on Wednesday; but prices were less favourable. Gaslight "A" fell 2; and Imperial Continental, 1¼. Business was about the same on Thursday in point of volume; and quotations were unchanged, except for a fall of 1 in Bristol. The general position remained much about the same on Friday. In Water, Lambeth debenture rose 2. Saturday was quiet, with prices mostly firm. Ottoman advanced ¼.

ELECTRIC LIGHTING MEMORANDA.

The Report of the St. Pancras Vestry Electric Lighting Committee—The Profit on the St. Pancras Undertaking—Consulting and Executive Electrical Engineers—Electricity and Gas for Railway Lighting.

In another column we give an account of the proceedings of the St. Pancras Vestry in connection with the reception of the report of their Electric Lighting Committee, which show that, so far as this Metropolitan Local Authority is concerned, electricity is a distinct cause of liveliness of debate. The report states, to begin with, that the past year's working of the undertaking was very satisfactory. It appears that the total capital expenditure has been nearly £110,000, which is almost double the original estimate. As to the revenue account, the report claims that, after paying all charges for repairs and maintenance, including rents and taxes, there is an available balance of £7233 to meet the interest and sinking fund charges, which amount to £5379; thus leaving a "net profit" of £1753 on the year's working. It is remarked that this sum, with the charges already mentioned, "is equivalent to a dividend of over 6 per cent. on the capital expenditure, and would be available for distribution to the shareholders, if the undertaking belonged to a company." An instructive comment upon this claim is supplied in the next paragraph of the report, which states that "the question of creating a reserve fund for depreciation has frequently been raised; but the Dublin Corporation are at one with St. Pancras in the view taken, that the amounts repaid annually off loans are, in reality, equivalent to setting aside a sum for depreciation." Of course, what commends itself to the Dublin Corporation in respect of municipal finance must be correct. All the same, one would like to hear other opinions as to the identity of sinking and depreciation funds in the case of undertakings established under the Electric Lighting Acts.

With regard to the claim that the St. Pancras undertaking pays what is equivalent to a dividend of 6 per cent. on the capital, a little investigation is necessary to an understanding

of the grounds on which such a remarkably pleasant showing reposes. In the first place, the Vestry themselves subsidize the concern by cheerfully paying £4426 for the public lighting, which is about double the former gas bill, to say nothing of the cost of the gas still used in the district. The sales of current by meter for all purposes amounted for the year to £12,056; wherefore, in showing the profit they do, the Vestry must be credited with great cleverness. How is it done? By charging against the undertaking only the barest manufacturing expenses, and cutting down renewals and repairs to the lowest possible figure. Even so, to keep the stations and mains in order cost about £2000, or nearly one-eighth of the revenue from lighting. An interesting statement is that of the electricity generated, sold, and otherwise accounted for. The total quantity generated was 918,297 units. Of this, the public lamps took 186,604 units; consumers by meter, 532,880; and 22,326 units are returned as "used on the works." The total quantity unaccounted for was therefore 126,534 units, or 13·7 per cent. of the whole output. These figures are significant of much, when read in connection with recent street disturbances.

The last topic of interest in connection with the St. Pancras electric lighting undertaking is the decision of the Vestry to follow the example set by the Hampstead Vestry, in getting rid of their Consulting Electrical Engineer. It is not for us to go into the details of the debate in the Vestry meeting upon this suggestion. At Hampstead, matters have been complicated, since the shelving of the Consulting Electrician, by the resignation of the chief executive officer, on whom the responsibility for managing the undertaking was to have been placed. It is with considerable satisfaction, however, that we note the resolve of both Vestries to pay reasonably good salaries to their Electrical Engineers. St. Pancras is willing to offer £600 a year, and Hampstead £300 a year to commence with, to the heads of the respective electric lighting undertakings; and it is certain that a wise policy in this regard is one of the first essentials in the proper conduct of such a business. There is not much likelihood of electrical engineers being overpaid for their services; but they deserve remuneration on a scale calculated in accordance with the difficulty of the work they are called upon to do, and the expensive character of a proper training for it.

Reference was made in this column last week to Mr. W. Langdon's paper on the application of electric lighting to railway purposes in general and the requirements of the Midland Company in particular. We had occasion to criticize one or two of Mr. Langdon's claims on behalf of his electric lighting; but we desire to return to the subject of his paper for the purpose of testifying to its excellence as an up-to-date statement of what is being done with both gas and electricity for the lighting of railway passenger stations and goods yards. Apart altogether from the conventional rating of 10-ampère arc lamps as of 2000-candle power, and of 6·8-ampère arcs as of 1200-candle power, which is absurd, Mr. Langdon makes out that there is a considerable saving for railway companies in the use of such means of lighting for their stations and goods yards when the current is generated on the spot, either by steam or gas power. He admits that the prime cost of an electric lighting plant would probably be greater than that of gas plant, even where it is not necessary to purchase land for the purpose; but he contends that even so the working expenses of the former will be less. It is desirable to point out, however, that this is so only when the superior illuminating power of the arc lamps is taken advantage of for spacing them at greater distances apart than are allowable for gas-lamps. Thus, if in the Birmingham yard 53 of the smaller arcs are substituted for 130 gas-lamps of 150-candle power each, the total cost of the lighting works out to 49·29d. for the former, as against 100d. for the latter. This can only be rendered possible by submitting the yard in favour of the electric light to a far greater degree of "spottiness" of effect than the gas would give. Lamp for lamp, there is little or no difference in the cost. It is of interest to note that Mr. Langdon is very doubtful as to the economy of making fuel gas specially for driving electric lighting engines, where coal gas can be had for something like 2s. 3d. per 1000 cubic feet. The cost of gas-made electric lighting at Leicester works out to 1·2d. per hour for 10-ampère arc lamps, and 2·3d. per unit for incandescent lights, which is decidedly cheap.

Death of Colonel Cowen.—It is with sorrow (which will be shared by a large circle of our readers in the North of England) that we have to announce the death of Colonel J. A. Cowen, of Blaydon Burn, on Sunday of last week, at the age of 63 years. In the spring of 1893, Colonel Cowen, who had always previously enjoyed robust health, was seized with a serious illness. For some months he was confined to the house; but he improved so far as to be able to resume his ordinary avocations. Shortly before Christmas, however, he caught cold, his illness returned, and from that time to his death, he never left his room. The deceased gentleman was a son of the late Sir Joseph Cowen. He was born at Blaydon Burn; and was educated first at a private school at Ryton, and afterwards at the college of Civil Engineers at Putney. After leaving college, he joined his father's firm—the well-known fire-brick and clay retort makers, and colliery owners—and also became connected with several local manufacturing enterprises.

EVIDENCE OF THE CONTROL OF INDUSTRIES BY WORKMEN-SHAREHOLDERS.

In the course of the controversy that has now been in progress for some time through the medium of the "Correspondence" and editorial columns of the Journal, over the workman-shareholder-director scheme suggested by Mr. George Livesey for the South Metropolitan Gas Company, it has been assumed by both sides that there is no experimental test in existence, or upon record, whereby the feasibility or impracticability of such an arrangement might be determined by reference to accomplished facts. No precedent of the kind has been offered by any participant in this discussion, which has been carried on throughout, as we have already shown, upon purely *a priori* reasoning. In the part we have taken in the controversy, editorially, we confess to having argued like everybody else (Mr. Livesey included), from mere presumptions which had no evidence to support them. So recently as the 9th inst., we observed that the feasibility of the arrangement under discussion was "purely a matter of opinion; and there does not exist any proof which could be adduced to clinch the argument on one side or the other." It is one of the advantages of a public *symposium* upon a debateable matter that, if it is continued long enough, any vital facts bearing upon the question at issue that may be in existence, albeit unknown to the disputants, are sure to come to light. In the case in point, the lack of experimental proof to which we confessed only a fortnight ago has now been largely supplied; and this from no more occult sources than the minutes of evidence taken before the Labour Commission, and Mr. Thomas Blandford's pamphlet on the Exhibition of Co-operative Productions at the Crystal Palace in August last, which is one of the publications of the Labour Association, whose central office is at No. 9, John Street, Adelphi. Henceforward, therefore, the controversy enters upon a fresh phase, in which the issue will no longer be the absolute possibility or feasibility of Mr. Livesey's proposal, but only its applicability to the circumstances of a gas undertaking. This will necessitate considerable change of front for Mr. Livesey's opponents.

We offer no apology for not having been aware of the existence of these pieces of evidence, inasmuch as they occur in connection with the manufacturing industries classified as textile, and would therefore not come under our notice in the ordinary way. If, however, according to Mr. John Ewart's view, even journalistic enterprises might supply instruction to gas administrators, it is unnecessary to argue for the profitableness of studying the solution of labour questions wheresoever they arise. To come to the particular question, a workman-director is, in point of fact, a workman and a director, a master and a servant, employer as well as employed, wherever he exists. Colonel Makins has proclaimed his scepticism as to the existence of such a "composite individual." But in his letter which we publish to-day, Mr. Livesey is able to state positively that the impossibility only obtains in Colonel Makins's imagination. The creature lives. For the sake of shortening this stage of the controversy, we propose explaining here where he is found, what he does, and how the arrangement works.

The first mention of the marvel that has been brought under our notice—only during the last few days—appears in the print of the minutes of the evidence taken by Group C of the Labour Commission on the tenth day, and was contributed by Mr. George Thomson, Managing-Director and Chairman of the firm of Messrs. Thomson and Sons, Limited, Woodhouse Mills, Huddersfield. Mr. Thomson had 30 years' experience of his trade; and his Company employed 140 workpeople. He told the Commissioners that, *in addition to the wages*—the point is for Colonel Makins—the firm had a profit-sharing scheme, under which 80 per cent. of the workpeople became co-partners and shareholders in the concern. Mr. Thomson's statements as to the effect of the scheme upon the participants are a revelation for those capitalists who are unwilling to ascribe even common honesty to the British workman when uncontaminated by imported socialistic poison. In reply to Mr. Mawdsley (we quote from the official notes), the witness's evidence ran as follows: "(*Q.* 7136.) Have these working shareholders any one of their number on the directorate?—Yes; they could not be on the directorate unless they were holders. (*Q.* 7137.) Are any of the Directors taken from the ranks of the workmen?—Yes; three are taken from our own workmen, and three others (at present we have lost two by death) are representatives of the workmen outside. (*Q.* 7138.) Have the Directors any power in controlling the business of the Company, apart from yourself, I mean?—Not initiation exactly; but all great changes, important orders of machinery, and so on, are all discussed by them. (*Q.* 7139.) What do they do when they discuss them? Do you decide on your own responsibility afterwards, whether you will accept their suggestions or not?—No; I think there has never been a case of that kind." In answer to further questions, witness said that out of seven actual Directors—there being two death vacancies waiting to be filled at the next annual meeting—three were workmen in the establishment, and three others were workmen from outside. The Board meetings are held monthly, and there are occasional meetings of what is called the Mill Committee, composed of the Chairman and the three workers in the mill, who report to the full Board. Question 7160, by

Mr. Courtney, ran as follows: "And you have never had any difficulty between yourself and your fellow-Directors?" The answer was: "Never; we have occasionally small differences of opinion, but we have never had any trouble whatever. I think one of the pleasantest experiences I have had is working with my Committee in this matter. I have only omitted one meeting for the five years that we have been in existence." Much of the witness's evidence was addressed to showing the difficulty of improving a trade that happens to be largely affected by changes of fashion, which certainly is not the case with a statutory gas undertaking. This evidence was taken in 1891.

The next stage shifts to the Co-operative Productions Exhibition of 1894. Mr. Blandford, in his "Account" of this exhibition and the cause which it was designed to advance, says of the necessity for an improved organization of labour. "It is not a question of renouncing the share of subordination inevitable in the conduct of all undertakings—no one thinks of renouncing that; but when the general opinion comes to have some share in framing the rules, then they will be more certainly obeyed. *It is the difference between despotic and constitutional Government.*" The italics are ours. It has been somewhere said that the mainstay of the British Constitution consists in the willing obedience rendered by free men to the laws they have themselves helped to make. The essence of the question now under discussion is the extension of the same principle into the organization of industrial establishments. Mr. Blandford claims, as one of the objects of the Labour Association, that it encourages profit-sharing, not because it is considered an end sufficient in itself, but because, when a workman becomes a shareholder through the capitalization of his proportion of profit, "it ensures him some share in the direction of affairs, it emphasizes the necessity for the worker to take his share of responsibility, and it trains him in a habit of considering the permanent well-being of the society as well as his own immediate advantage." The society here alluded to is, of course, a co-operative society; but the observation has no necessary limit. Mr. Blandford speaks quite naturally of societies governed by committees consisting sometimes "partly of outside shareholders and partly of workers in the shop," and of others "governed by committees consisting of working shareholders employed in the place." Elsewhere he states that the labour co-partnership movement in round figures "now comprises 108 societies, £639,000 capital, £1,292,000 annual trade."

Mr. Blandford proceeds to give details concerning the exhibiting Societies. One of these was the Alcester Co-operative Needle Manufacturing Society, Limited, which started in a very small way in 1887. This is described as a venture in an extremely difficult trade; and, under the rules, the Committee includes "two workers." The Bristol Pioneers' Boot and Shoe Productive Society has working members eligible for the Committee. Brownfield's Guild Pottery Society, Limited, appears to be managed by the workers. The Burnley Self-Help Cotton-Spinning Manufacturing Society, Limited, is administered by a Committee elected from the workers. Of the Coventry Co-operative Watch Manufacturing Society, Limited, it is stated that "the governing body is a Committee consisting almost entirely of practical watchmakers; and they have directed the Society well." Many other similar instances might be cited; among the most important being the Leicester Co-operative Boot and Shoe Manufacturing Society, Limited, who have a governing body consisting of President, Treasurer, Secretary, and Committee, all elected in general meeting by the workers themselves out of their own body. Those who desire further information upon this and cognate subjects are referred to Mr. Blandford's pamphlets and other publications of the Labour Association, including the monthly periodical entitled "Labour Co-partnership," which is a record of the results of the working of over a hundred societies, doing a trade of £1,300,000 a year, whose workers "share in profit, capital, and control."

This should be sufficient evidence to prove that those who contemplate strengthening the bonds that already exist to bind labour to capital in indissoluble unity, by admitting workers to a share in the responsibilities of administration, are not wholly without guidance by the light of experience in this regard. It is done over and over again in co-operative establishments. And not only in these; for the firm of Messrs. Thomson and Sons, Limited, works with capital not provided by the method of co-operation. Of course, these are not gas-works. But a beginning must be made with gas undertakings somehow, if this industry is not to remain outside the operation of the reforming method of internal co-partnership. It is not a method to be forced upon any undertaking without the goodwill of both parties to the bargain of employment. But—and the point is a grave one—there is every reason why any advance of the kind should be made from above; from the "Haves," for the benefit of the "Have-nots." This is the way of English Reforms; and it distinguishes them from Revolutions. Not only political, but industrial history also is full of examples of concessions freely granted by those who had the power to give and to withhold—not in response to clamorous demand, but in accordance with the promptings of an enlightened sense of the right. Why, there are many gas undertakings at work in the United Kingdom at this moment, whose management habitually does more for the public than the law, or even than such public opinion as usually makes itself heard, demands. These undertakings give sometimes an unasked addition to the statutory illuminating power required for their gas; sometimes they do not pay the full dividends to which their proprietors are entitled; frequently they do not raise the retail price of coke against the poor when a hard frost pinches; and they have even been reluctant to displace hand labour by machinery in gas making, when it was merely a question of effecting a certain economy by so doing. These things are done out of a sense of what is right and reasonable in certain circumstances. Well, in this matter of the reform of labour conditions in gas-works, we would similarly prefer that whatever is done should be done for the same reason. This is at least certain—that in the future there will be changes in the industrial as in other departments of our common civilization; and one of these changes will be the dethronement of the *à priori* predilections of that order of employers who think that labour will always be content to run in leading-strings. The incoherencies of socialistic demagogues, such as those which have been promulgated from Newcastle during the past few days, may cause the better instructed to smile; but with the smile will come to the thoughtful a regret that the demands of those who assert themselves as the mouthpieces of the "Have-nots" should be so outrageous. Yet this is the sort of thing that Colonel Makins professes himself willing to wait for; these are wishes of the wage-earners, some of them enrolled in the ranks of gas workers. For if these people, ignorant of business and the responsibilities of industrial administration as they are, utter unreasonable demands, is it to be wondered at? What guarantee have we that, after we have waited for them to speak, they will say exactly what we regard as reasonable? Again we repeat, the way of reform is from above, downward; and when the initiative passes from the hands of those to whom power has descended, and is seized upon by the mob, then will come "red ruin, and the breaking up of laws."

COAL-DUST AS AN EXPLOSIVE AGENT.*

An interesting work that was recently issued from the pen of Mr. Donald M. D. Stuart gives an exhaustive account of the explosion which occurred at the Camerton Collieries, Somersetshire, on Nov. 14, 1893, illustrated with carefully drawn plans and sections of the mine and the several strata in which the coal beds lie. All the evidence which the author has thus collected and marshalled, clearly proves that coal-dust was the principal agent to cause the successive explosions; and these were probably transmitted to some gaseous material. The explosions, ten in number, were distributed over roadways 1775 yards, or (say) a mile, in length. When, in ten hours after the explosion, the roads where they occurred were examined, they gave no evidence of carbon dioxide, although that gas was in other parts of the mine evolved in such quantities as to extinguish the candles. Professor Frank Clowes has remarked that the fact of the gas being unable to support combustion is no evidence that it may not support life; otherwise we presume the exploring party could not have entered the parts of the mine where no explosion had occurred. It appears to the author that "a volume of highly heated gas emerges from each explosion, with the potentiality of repeating the explosive phenomena after an interval." Mr. Roskell's late report on the Albion Colliery says: "Whatever the source of the explosion, the extent and intensity of ranges were due to coal-dust."

These explosions, which seem to have increased in late years, have been investigated by Mr. Stuart with an ability and assiduity that promise important results. The presence of another explosive agent besides methane has long been recognized; and many mining engineers have devoted considerable labour to discover the part that this auxiliary agent plays in an explosion. Mr. Hall, Messrs. Atkinson (Inspectors of Mines), Mr. Galloway, Mr. Garforth, and numerous other engineers, besides Committees of the Mining Institutions, have advanced important evidence from time to time, showing that coal-dust was a serious danger. But up to a certain date explosions had only occurred in mines yielding methane; and the body of managers and the mining world were of opinion that this gas was the chief agent, though coal-dust may have aided the propagation of the explosion when once it was set going. The explosions referred to, however, occurred at mines absolutely free from methane; so that the occasion arose for investigating an explosion in which coal-dust was the only agent present.

Mr. Stuart's book marks a new departure in the consideration of the subject. Hitherto the general features only of the effects of explosions have been observed; but Mr. Stuart goes much more deeply into the question—firstly in compiling a mass of minute observations and data; secondly, in a scientific examination of these records; and, finally, by means of extensive drawings, he advances important theories upon the initiation and propagation of an explosion in a colliery, and propounds the *rationale* of such an explosion. The book has naturally received a considerable amount of attention.

The theories have been accepted by a great many scientific

* "Coal-Dust an Explosive Agent, as Shown by an Examination of the Camerton Explosion." With seven plates. By Donald M. D. Stuart, F.G.S., Mining and Civil Engineer. London: E. and F. N. Spon.

men; and though they were made public in August last, no one has yet attempted to controvert or assail them. In December, Professor Vivian B. Lewes lectured before the Society of Arts on "Explosives;" and after drawing upon Mr. Stuart's book, he advanced a theory that carbon monoxide was the factor in colliery explosions. Mr. Stuart's idea is that hydrogen is the factor in the ultimate explosion; and he has advanced an amount of evidence in support of his theory that commands attention for it. He has the advantage of a large experience in coal mining; and he is therefore conversant with the conditions under which these calamities occur.

The subject of the danger of coal-dust has again come into painful prominence, by an explosion in February at the Timsbury Mines, which adjoin the Camerton Colliery, and are also non-gaseous. In this case, seven lives were lost. Yet another explosion occurred last month at the Malago Vale Colliery in the same disirict, where two men were killed. In both cases the explosions happened when only a few men were in the mines, and a few hours before the time when about two hundred men would have been engaged. In the Timsbury explosion, the part played by the coal-dust is beyond question; but Professor Lewes's theory of carbon monoxide was advanced by the expert on behalf of the owners, as the initiating factor with the gunpowder shot in starting the explosion. That carbon monoxide can assume this function in a colliery explosion is at least open to question. It must, however, be considered; and there cannot be any insurmountable difficulty in subjecting the idea to practical and scientific examination.

What is now required is that the functions of coal-dust in these disasters should be cleared up; and the two latest explosions at Timsbury and Malago Vale offer great opportunities for further investigation. If all the indications and evidences they provide are observed and recorded with the scrupulousness Mr. Stuart applied to the Camerton explosion, we shall then have important data for testing his theories, and also Professor Lewes's carbon monoxide idea. If one or the other be proved corrrect, explosions from coal-dust ought not to be repeated.

Out of the nettle we may pluck the flower; and it is possible that these coal-dust explosions may yet be turned to useful account, as gas explosions have been put in harness in the gas-motor. Is it not possible that coal-dust may yet be employed in internal combustion engines? Of course inconvenience would arise from the ash and tarry products of combustion; but some system of scavenging may be devised which would remove this difficulty. We would then, in all probability, have the cheapest form of heat-engine ever invented.

Association of Gas Engineers of Austria-Hungary.—The annual meeting of this Association will be held this year at Salzburg, on the 24th and 25th prox. Herr C. Bauer is the President for the year.

The German Association of Gas and Water Engineers hold their annual meeting this year at Cologne, from the 18th to the 22nd of June, under the presidency of Herr Wunder, of the Leipsic Gas-Works.

Railway-Carriage Lighting in Germany.—The *Zeitschrift für Beleuchtungswesen* states that 85·4 per cent. of the passenger cars on the German railways were lit by gas in 1894, against 60·9 per cent. in 1886.

North of England Gas Managers' Association.—The business for the thirty-sixth half-yearly meeting of this Association, to be held next Saturday, at Newcastle-on-Tyne, includes a paper by the President (Colonel Sadler, J.P.), entitled "A Few Notes on Gas Enrichment," and one by Mr. W. Hardie, jun., of Tynemouth, on "The Frost and the Gas." The officers for the ensuing year will be elected; and there will be a dinner in the County Hotel at the close of the proceedings.

South-West of England District Association of Gas Managers.—The next meeting of this Association will be held at the Winchester Gas-Works on Tuesday, the 30th inst., under the presidency of Mr. F. G. Dexter, the Engineer and Manager of the Winchester Water and Gas Company. The business will comprise the reading of the President's Inaugural Address, and a paper by Mr. J. S. Ineson, of Ventnor, recounting some of the difficulties he has experienced in connection with the management of the gas-works there. This will probably give rise to a discussion. After the meeting, the gas and water works will be inspected, under the guidance of the President; and the proceedings will conclude with a dinner at the Royal Hotel.

Death of Herr Lothar Meyer.—The death is announced, as having taken place on the 12th inst., of Dr. Julius Lothar von Meyer, Professor of Chemistry at Tübingen University. This distinguished chemist was born in 1830 at Varel, in Oldenburg; and at first he studied for a medical career, afterwards devoting himself entirely to Chemistry and Physics. He held various professional posts until, in 1876, he took that at Tübingen which he held till his death. His earliest published work was in the field of physiological chemistry, and treated of the changes in the colouring matter of the blood under the influence of oxygen and carbonic oxide. His more important later work was on theoretical chemistry, and is well known to English students through the translation, by Messrs. Bedson and Williams, of his standard text-book, "Modern Theories of Chemistry."

NOTES.

Lord Rayleigh on Sensitive Flames.

In the course of a lecture on waves and vibrations, delivered at the Royal Institution, Lord Rayleigh introduced the subject of sensitive gas-flames, in connection with which the name of the late Professor Tyndall was so celebrated, as they were with him a favourite object of demonstration. The old sensitive flame was simply a pin-hole gas-jet, with the gas issuing at a considerable pressure. When the gas was adjusted to burn just under the flaring point, the flame became exceedingly sensitive to all noises, cowering down like a frightened thing if hissed at, and dancing in an excited way to the high notes of a violin. Lord Rayleigh has improved upon this arrangement, by constructing a gas-burner which better illustrates the actual cause of the sensitiveness. It is not the flame which is sensitive, but the whole column of gas; and the flame only serves to render the vibrations of the gas-supply visible. In Lord Rayleigh's arrangement, the gas is not burnt directly upon issuing from the pin-hole jet, but is led first into a wide chamber, from which rises a moderately large pipe, like that of an atmospheric burner; and the gas is burnt on the top of this. There is a hole in one side of the wide chamber, across which is stretched a thin sheet of paper, or other membrane, to receive the vibrations. By this means, it is possible to show the phenomena of the sensitive flame with gas at the ordinary pressure. The vibrations communicated to the gas by the membrane have the effect of breaking up the flow. Lord Rayleigh showed that such a flame is sensitive to the least whisper of a tuning fork of the proper pitch. The phenomena are not peculiar to gas, but can be repeated with all streams of fluid pouring into identical media. They are due to the viscosity possessed in varying degrees by gases and fluids, and more by gases than by fluids.

The Direct Production of Electricity from Fuel.

Commenting upon the questions raised with respect to the functioning of the Borchers fuel-gas battery, Mr. Carl Hering, who is described by the *Electrical Review* as inclining to the view that success is likely to be attained by some indirect method of causing oxidation of the fuel gas, describes an interesting experiment made by himself and Mr. von Dobrowolski some years ago, which appears to show that a galvanic cell can be made to generate current by what may be called the cold combustion of common coal gas. Two battery carbons were carefully cleaned, and platinized with platinum black. They were then placed in a bath of dilute sulphuric acid, and kept short-circuited for some time, in order to discharge them. One carbon was then placed in a jar containing ordinary illuminating gas from the street mains; and the other was exposed to the air. After awhile, they were again inserted in the acid bath, and connected to a crude galvanometer. By making and breaking the circuit at proper intervals, the needle of the galvanometer could be caused to spin round. Exact measurements were not made; but our electrical contemporary observes that it would be well if some precise determinations of the electro-motive force and resistance of this form of gas-battery were forthcoming. While on this subject, it may be interesting to note that a paper by Lord Kelvin, Magnus Maclean, and Alexander Gall was recently read at the Royal Society, upon the electrification of air and other gases, by causing them merely to bubble through water and various aqueous solutions. The paper describes the methods of operating followed by the authors. Carbonic acid gas blown through pure water into an insulated glass jar was found to produce an electrification of 8·75 volts positive in ten minutes. Oxygen only gave half a volt in ten minutes; hydrogen, 2 volts positive; and coal gas 1·4 volts positive.

Another Product of Escaped Electricity.

As bearing upon the question of the formation of unexpected chemical compounds in street culverts, &c., by escaping electricity, Mr. Arthur Wright, the Engineer and Manager of the Brighton Corporation Electricity Works, writes to the *Electrician* to describe a mysterious circumstance that occurred in this town last October, when it was discovered that "shocks" could be obtained from the casing of the electric lighting service in a certain house. Inspection revealed the fact that the casing in question was covered with "a furring similar to that noticed on new buildings;" and on removing the cover, a serious leak was discovered, from a badly-made joint to a nail in an old wall. There were no evidences of charring. The whole of the casing was saturated with moisture; and there was a hole in it with edges of a light brown furry nature. On the surface of the capping that had been in contact with this faulty joint, there was a large accumulation of a white pasty deposit, yielding sparks freely upon rubbing with the finger, even after removal. Mr. Wright testifies to the fact that for several days after the piece of capping had been brought to the works for examination, brilliant but minute flashes of light could be obtained from its under surface by drawing the finger over it. The trouble that might have ensued by the combination of escaped gas with this unnamed product of escaped electricity, of course, need not here be dilated upon.

ACCOUNTS OF THE METROPOLITAN GAS COMPANIES FOR THE YEAR 1894.

—	Chartered.	Commercial.	South Metropolitan.	All the Companies.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Capital and borrowed money	12,169,250 0 0	880,000 0 0	3,389,899 0 0	16,439,149 0 0
Income—viz.:				
Sale of gas by meter	2,546,590 4 2	243,479 6 11	767,387 8 11	3,557,457 0 0
Public lighting, including lighting under contracts	147,714 5 8	18,894 4 5	60,390 16 4	226,999 6 5
Rental of meters and stoves	77,384 2 9	6,277 19 5	32,594 12 9	116,256 14 11
Residual products	815,968 11 1	97,958 14 3	341,714 5 0	1,255,641 10 4
Miscellaneous, including old materials	12,925 17 1	918 3 11	5,970 15 1	19,814 16 1
Total income from all sources	3,600,583 0 9	367,528 8 11	1,208,057 18 1	5,176,169 7 9
Expenditure—viz.				
Coal and oil, including carriage and dues	1,094,008 11 9	127,429 9 4	392,378 17 1	1,613,816 18 2
Purifying materials, including labour	62,726 12 11	7,861 5 4	18,911 13 11	89,499 12 2
Salaries and wages—manufacture	348,410 4 5	40,951 9 4	108,199 18 7	497,561 12 4
Wear and tear—manufacture	318,308 2 3	39,685 14 8	136,977 6 0	494,971 2 11
Rents, rates, and taxes	195,992 8 8	12,305 12 10	43,859 12 10	252,157 14 4
Salaries—management	15,375 6 5	2,254 0 0	3,989 15 2	21,619 1 7
Collectors' salaries and commission	30,777 5 2	3,020 19 6	11,878 0 3	45,676 4 11
Stationery, printing, and general charges	12,350 11 4	1,855 16 2	9,720 4 7	23,926 12 1
Directors and auditors	5,900 0 0	2,650 0 0	3,725 0 0	12,275 0 0
Salaries and wages, wear and tear—distribution	142,692 7 10	16,167 5 7	64,455 15 6†	223,315 8 11
Repair and renewal of meters and stoves	85,899 13 0	5,498 11 2	28,216 15 1	119,614 19 3
Law and parliamentary charges	4,116 7 9	465 5 7	4,906 10 6	9,488 3 10
Bad debts and extraordinary expenses	41,530 4 0*	3,378 1 9	24,345 1 4‡	69,253 7 1
Total expenditure on revenue account	2,358,087 15 6	263,523 11 3	851,564 10 10	3,473,175 17 7
Gross profit	1,242,495 5 3	104,004 17 8	356,493 7 3	1,702,993 10 2
Do. per cent. on capital and borrowed money	10 4 3	10 3 8	10 10 4	10 7 3
Do. do. gas-rental	46 2 4	39 12 10	43 1 4	45 0 0

* Including £21,542 annuities. † Including £5,091 15s. 10d. labour in connection with gas-fittings. ‡ Including £12,435 10s. 9d. paid under profit-sharing scheme.

TABLE *showing the Capital, Income, Expenditure, and Profit, per Ton of Coal Carbonized (including Oil), in* 1894

—	Chartered.	Commercial.	South Metropolitan.	All the Companies.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Capital and borrowed money	6 7 10·34	4 1 7·23	4 11 1·12	5 14 9·94
Income—viz.:				
Total gas-rental	1 8 3·71	1 4 3·96	1 2 3·00	1 6 5·22
Rental of meters and stoves	9·76	6·98	10·52	9·74
Residual products	8 6·88	9 1·00	9 2·22	8 9·25
Miscellaneous, including old materials	1·63	1·02	1·92	1·66
Total income from all sources	1 17 9·98	1 14 0·96	1 12 5·66	1 16 1·87
Expenditure—viz.:				
Coal and oil, including carriage and dues	11 5·94	11 9·80	10 6·56	11 3·27
Purifying materials, including labour	7·91	8·75	6·10	7·50
Salaries and wages—manufacture	3 7·93	3 9·57	2 10·90	3 5·71
Wear and tear—manufacture	3 4·13	3 8·16	3 8·18	3 5·49
Rents, rates, and taxes	2 0·71	1 1·70	1 2·15	1 9·14
Salaries—management	1·94	2·51	1·29	1·81
Collectors' salaries and commission	3·88	3·36	3·83	3·83
Stationery, printing, and general charges	1·56	2·06	3·13	2·00
Directors and auditors	0·74	2·95	1·20	1·03
Salaries and wages, wear and tear—distribution	1 5·99	1 5·98	1 8·79	1 6·72
Repair and renewal of meters and stoves	10·83	6·12	9·10	10·02
Law and parliamentary charges	0·52	0·51	1·58	0·79
Bad debts and extraordinary expenses	5·24	3·76	7·86	5·81
Total expenditure on revenue account	1 4 9·32	1 4 5·23	1 2 10·67	1 4 3·12
Gross profit	13 0·66	9 7·73	9 6·99	11 10·75

TABLE *showing Increase or Decrease in each Item during* 1894 *compared with* 1893.

—	Chartered.		Commercial.		South Metropolitan.		All the Companies.	
	Inc.	Dec.	Inc.	Dec.	Inc.	Dec.	Inc.	Dec.
	£	£	£	£	£	£	£	£
Capital and borrowed money	..	..	..	..	113,482	..	113,482	..
Income—viz.:								
Sale of gas by meter	..	82,282	..	10,751	26,050	..	..	66,983
Public lighting, including lighting under contracts	2,389	..	69	..	493	..	2,950	..
Rental of meters and stoves	1 578	..	552	..	5,765	..	7,895	..
Residual products	85,199	..	3,554	..	41,460	..	130,213	..
Miscellaneous, including old materials	..	1,240	199	..	287	..	..	754
Total income from all sources	5,644	..	..	6,377	74,055	..	73,321	..
Expenditure—viz.:								
Coal and oil, including carriage and dues	..	117,604	..	6,602	8,151	..	..	116,053
Purifying materials, including labour	2,377	..	..	263	..	577	1,538	..
Salaries and wages—manufacture	1,728	..	..	31	..	2,771	..	1,076
Wear and tear—manufacture	..	16,736	2,774	..	28,299	..	14,337	..
Rents, rates, and taxes	10,878	..	739	..	4,248	..	15,864	..
Salaries—management	..	546	22	..	158	..	..	367
Collectors' salaries and commission	493	..	89	..	1,948	..	2,530	..
Stationery, printing, and general charges	1,016	..	126	..	..	193	950	..
Directors and auditors	..	..	..	..	..	..	..	..
Salaries and wages, wear and tear—distribution	5,567	..	..	62	10,635	..	16,140	..
Repair and renewal of meters and stoves	4,061	..	478	..	5,016	..	9,554	..
Law and parliamentary charges	..	15,133	..	207	..	1,108	..	16,449
Bad debts and extraordinary expenses	..	1,091	99	..	..	1,426	..	2,418
Total expenditure on revenue account	..	124,990	..	2,839	52,380	..	..	75,450
Gross profit	130,634	..	..	3,538	21,675	..	148,771	..
Do. per cent. on capital and borrowed money	£1 1s. 6d.	..	..	£2 0s. 9d.	£0 6s. 6d.	..	£0 16s. 10d.	..
Do. do. gas-rental	6 0 9	..	£8 12s. 3d	..	1 5 8	..	4 12 3	..

TECHNICAL RECORD.

OHIO (U.S.A.) GASLIGHT ASSOCIATION.

Annual Meeting at Springfield.

The Eleventh Annual Meeting of this Association was held at Springfield, Ohio, on the 20th and 21st ult.—Mr. J. W. R. CLINE, of Springfield, the President, in the chair.

There was a considerable amount of preliminary business. The Special Committees appointed to consider respectively the questions of selling tar and federation were discharged. After recognizing the presence of visitors from other districts,

The President delivered an Inaugural Address. Referring to the competition of electricity and gas, he said that the hard times, the shadow of which still hung over the land, were favourable to their own special industry, as electric lights were displaced in favour of the lower-priced gas. He spoke highly of the Welsbach burner as a weapon for competing with electricity; and he strongly urged the members to introduce and promote the use of that appliance. Passing to the question of municipal ownership of gas-works, he claimed that it had never been fairly and honestly demonstrated that a municipal corporation could perform its own lighting service cheaper than a private company could do it; while there were numerous instances of municipal gas undertakings having deficits to be made up by taxation. Where gas-works already existed, it was unnecessary expenditure and waste of public money to embark in the business. As to taxing or licensing gas franchises, there was neither justice nor equity in the propositions to tax regulated franchises, the privileges of which were already covered by restrictions. The President heartily supported the encouragement and development of day consumption, as well as the introduction of ornamental portable gas-lamps for domestic use. Gas as a source of motive power was at present in its infancy. Every day added to the popularity of gas-engines; and this branch would eventually become an important source of revenue. Especially was this the case with regard to street-cars, which could be driven by gas-engines at a lower first cost, and at less expense in working, than by any other means. As to the proposed scheme for the federation of gas associations, his voice and influence would be against it.

Mr. E. T. M'Cörmack, of London (Ohio), submitted a short paper advocating ample storage capacity. He did not think that an excess of 50 per cent. over the maximum daily output was too much for a small works. Discussion being invited, Mr. Clapp urged that the storage capacity should be well able to take care of the variations in demand, so that the operations of manufacture and purification could be steadily and regularly kept up. Of course, coal-gas plant required a larger margin than water gas. Mr. Pritchard said that, with a varying consumption and small storage—only 50 per cent. of a maximum day's output—he experienced a large extra expense for labour, &c.; and he was therefore inclined to support the author of the paper. Mr. Butterworth said that they were often reminded of the advantage of being able to store gas, whereas electricity must be produced as required. But gas could not be stored to advantage without proper holder capacity. Mr. Douglas quoted an example showing that water gas could be worked with advantage in connection with large storage capacity.

A paper entitled "Changing the Arrangements of a Retort-House, and the Benefits Derived Therefrom," was read by Mr. A. F. Nash, of Windsor. The change referred to in the title was the replacing of two beds of threes and one of fives (ordinary settings) by two beds of settings on the half-depth regenerator system. The retort-house was only 28 ft. by 35 ft.; and the new settings were erected transversely at one end without stopping gas making, which was a somewhat delicate task. The author was well satisfied with the change, which had proved beneficial in every way. He had better heats, made more gas with less labour, and also doubled the productive capacity without enlarging the retort-house. The new retorts were 15 in. by 26 in. by 9 ft., with six in each setting; and the generators were 4 ft. by 1 ft. 6 in. at the grate-bars, spreading to 2 ft. 6 in. wide at 1 foot above the bars and sloping at the back. The depth from the bars to the arch was 4 feet; and the fire was kept between 2 feet and 3 feet deep. The primary air travelled through a 6-inch square flue, 16 feet long, situated under the ordinary bottom flue; and thence to the side of the furnace, to which it was admitted by four openings immediately under the grate-bars. But one disadvantage of this was that small coke and ashes were apt to get into the openings. There were fourteen openings in the furnace-arch for the escape of gases into the setting; and in close proximity, a similar number of openings for introducing the secondary air, which was highly heated by passing three times round the flue. His experience led him to suggest that the air-openings should be large, and readily accessible for cleaning. Having a good chimney, he was able to work with only 1 inch of damper, and 3½ inches area at the primary and secondary air supply. The bars were shaken up every four or six hours; but they did not require to use the supplementary bars for full clinkering oftener than twice a week.

The paper was the means of rousing a good discussion. Mr. Penn found that his experience agreed with that of the author; and there was a large saving of fuel. Mr. Cowdery had, like the author, adopted regenerator furnaces; and he considered that in doing so he had made a desirable change. Mr. Gwynn thought it would be generally admitted that the regenerator furnaces had an advantage over ordinary settings. At the same time, much of the trouble with the common settings was caused by crude construction and light arches. Carbonization should take place in 3 to 3½ hours, to get the best results. With heavy arches, and proper care, nearly as good work could be obtained from a common setting as from a half-depth regenerator furnace. He had some ordinary bridge-wall settings, with retorts 14 in. by 26 in. by 9 ft.; and the yield per day was 8300 cubic feet. The arches and outer walls of these were 27 inches thick, and covered with 4 inches of asbestos fibre; and the front walls were 11 inches thick, with a 2-inch layer of asbestos between the courses.

Mr. Butterworth considered that he secured as good results from half-depth as from full-depth regenerator furnaces. Mr. Coombs said he obtained about 5000 cubic feet per mouthpiece from ordinary settings; and he believed this was the usual figure. The result named by Mr. Gwynn was exceptional; and he would like to hear if anyone else who was present had been able to approach it. Mr. Bredel remarked that it was a mistake to suppose that asbestos fibre was a good non-conductor of heat. It was certainly fire-proof; but fire-brick, red-brick, or ashes were better non-conductors. Mr. Clapp suggested that if Mr. Gwynn was to use regenerator furnaces with the precautions he had named, he would get proportionately better results. Mr. Printz had been using both the old style and the half-depth regenerator furnace; and his experience was much in favour of the latter. The work was easier, there were better heats with less fuel. With the old furnaces, he required 40 per cent. or more of the coke for fuel; but with regenerators he used only 25 per cent., and carbonized more coal in less time. Mr. Jenkins said that for works making 50 million feet a year or so, it was better to start with the half-depth, as being less costly; and full depth furnaces could be put in later. Mr Nash understood that Mr. Gwynn had simply adapted to ordinary settings the construction of arch, &c., that was usual with regenerators.

Mr. W. S. Bowen, of Philadelphia, read a paper on "Soft-Coal Water Gas." He used an apparatus in which the soft coal was fed in by hoppers, in charges of 50 lbs. to 60 lbs., and caused to give off its gas. The resultant coke was converted into water gas in the usual way, without being moved or handled. The mixed gases passed to a carburetter, where they were enriched with oil gas; next through a mass of incandescent coke; and lastly through a superheater. This could all be done in one circular shell, containing separate compartments for generators, carburetters, coke, and superheaters. The material required per 1000 cubic feet of 20-candle gas produced was 30 lbs. of bituminous coal, 5 lbs. of coke, and 2½ gallons of oil. The apparatus was worked on the practice usual with water gas. A fresh charge was introduced at the beginning of each run, and so proportioned in weight as to admit of all the gas being given off in one ordinary ten minutes' run. The coke treatment converted the carbonic acid into carbonic oxide, and also secured other advantages. The composition of the gas was as follows: Illuminants, 15 per cent.; hydrogen, 36 per cent.; marsh gas, 23 per cent.; carbonic oxide, 19 per cent.; and carbonic acid, 2 per cent. With his apparatus, he secured a close and compact bed in the generators, free from "steam fissures;" and even heat was maintained by large bodies of checker-brick work at many points. Runs were made in 10 to 12 minutes, and "heating-up" by blast in 4 or 5 minutes. Comparing this system with the ordinary retort system, the author claimed that it yielded 50,000 to 60,000 cubic feet of gas per ton of coal that could be enriched with oil to any desired extent. Small or cheap coal could be used; and there was no deposit of carbon in the coke chamber. There was very little tar formed; and he claimed that the process was superior to the usual water gas, either with or without ordinary coal gas. The apparatus had been worked with great success last winter, for supplementing the natural gas supply at times of heavy consumption. It had been worked up to a production of 50,000 cubic feet per hour, and was readily stopped or started as might be required. The consumption of coal for raising steam was about 10 lbs. per 1000 cubic feet.

After a discussion of a conversational nature, a paper on "Prepayment Gas-Meters" was read by Mr. John D. M'Ilhenny, of Philadelphia (Pa.), who said that this was a means of securing the custom of the daily-wage earning class, who at present did not use gas. The gas company did not care to run monthly accounts on credit to small tenants; and such tenants either could not or would not pay a deposit. Yet it would be advantageous to secure their custom. The majority of them could be served from the present system of mains; and an outlay for prepayment meters meant a prompt and certain increase of business. Many who hesitated at this step, did not scruple to lay mains in outside districts for a return prospective rather than immediate. It should also be remembered that a large number of small customers was a safer line than a few large ones. The system had made rapid strides in England. In Liverpool, 12,000 consumers were using them; and this represented a largely increased consumption. In the South of London, the average annual consumption of gas per prepayment meter was 11,500 cubic feet; and in other places it had approached to 20,000 cubic feet—it being found that more gas was used with

them than by the same class of customer on the ordinary system. As to the expense of fitting up, the author calculated that the complete cost of meter, two or three common fittings, and a gas boiling-ring, would be $15 to $30 per consumer. Assuming an average consumption of 15,000 cubic feet of gas per annum, an extra charge of 20 c. per 1000 cubic feet would yield $3; so this expense could be easily met. But the gas must be sold at a rate low enough to ensure its use for cooking, as the business would be hardly worth securing if the gas were used for lighting only. The question to consider was whether the gas was cheap enough to induce the working classes to use it. It was said that people in England were different from those in America; but he thought human nature was much the same everywhere. One advantage was that the consumer did not know exactly how much he spent, and therefore could not compare his bill with the corresponding period of the preceding year. After explaining the construction of prepayment meters, the author urged that the conditions were not unfavourable for their introduction in the States.

The discussion on the paper was started by Mr. Butterworth, who gave an illustration of the value of prepayment meters in accommodating a discontented consumer. Mr. Holmes spoke of the cost of the meters. He said he thought that, as a rule, small consumers were not remunerative. Mr. Allen did not agree with this remark, and expressed the opinion that the system was worth looking into as a means of securing a new class of business. Mr. Gribbell remarked that the prepayment meter was a success wherever it had been adopted. The consumers were satisfied, and used more gas than they would have done under the old plan.

"The Progress of the Welsbach Light during the Past Year" was submitted as a subject for discussion. Mr. Gwynn remarked that the mantles now sent out were not so good as those supplied last year. In the rush of business, a number of poor mantles had been supplied. Mr. Stephens (the representative of the Welsbach Company) said the chief difficulty during the last twelve months had been to keep up with the orders. Since the new No. 20 lamp and No. 169 mantles had been brought out, the supply had never been up to the demand. This position of affairs would soon be remedied. The burner had not been altered, but the mantles were stronger and better. Many had been upwards of six months in use, and he did not think this could be improved upon. All the mantles were examined before being sent from the factory, and all were equally good; so he thought any trouble of the nature described by Mr. Gwynn must be due to subsequent treatment in transit, unpacking, or fixing. As to the greenish tint complained of, there was nothing in the constituents of the mantle to cause it; and he was not accountable for people who were colour-blind. Some care was necessary, also, in lighting the burner. With regard to want of uniformity in size, some mantles shrank more than others in burning off. The burners could be adjusted to suit any pressure; but if they were used under a higher pressure than they were rated for, too much gas would pass, and the mantles would soon fail. If the light were fixed and handled only by persons who had taken the trouble to acquaint themselves thoroughly with the principles of its action, he thought there would be little complaint. Mr. Butterworth said he had been told that the self-lighters, or pilot jets, used with the burners consumed 225 cubic feet of gas per month. Some experiments he had made gave a result of less than 250 cubic feet. It only used 0·3 cubic foot per hour; and he considered the device a very satisfactory one. He had every faith in the incandescent gas-burner, and believed gas companies would do well to push it. Mr. Allen agreed; saying that it was a mistake to look at the diminished consumption as compared with ordinary burners. Their greatest competitor was coal oil; and the cheaper the light furnished by gas, the better. He certainly had some trouble with the mantles; and he was glad to hear Mr. Stephens's explanation on this point. Mr. Olds said that at Springfield they had 2000 Welsbachs in use, and did not require more than 100 mantles per month. Mr. Boyle spoke in favour of the system; saying he had sold nearly 500 Welsbach burners, two-thirds of which replaced other modes of lighting than gas. He thought Mr. Gwynn's difficulty was the result of rich gas. Mr. Gwynn said his way of lighting the incandescent burner was different from that indicated by the authorized instructions. He preferred to turn the gas on full, and light at the top of the chimney, which gave a milder explosion than when only a little gas was turned on. The faults he complained of were open and porous places, or sometimes splits, apparently due to defects in the knitting of the mantles; the chemicals had nothing to do with it. There were several gentlemen present who had had similar experience; and he accounted for it by overwork, and perhaps inexperienced hands at the factory. He was pleased with the light, but not with the poor mantles. He understood about adjusting the burner to avoid excessive consumption; and he usually did this at the consumer's premises. Other gentlemen having expressed approval of the system, Mr. Lynn said his experience was similar to that of a previous speaker with regard to mantles, and the defects could not all be due to shipping, &c. They were not equal all over, and holes soon appeared in the thin parts. Perhaps some parts took up more of the chemical solution than others. Mr. Brown thought splits or punctures were often caused by shaking or jarring the gas-fittings. Mr. Jenkins said he had had some trouble with mantles, but had traced it to want of care in fixing. He set one man to the work, who soon became so expert at fixing the mantles that no more difficulty arose. He might mention that two of the burners had been under conflagration lately in his district. The premises were gutted; but the burners and mantles were not injured in the least.

(To be continued.)

NOTES ON WATER GAS.

At the Meeting of the West of Scotland Iron and Steel Institute, in Glasgow, last Friday, Mr. GEORGE RITCHIE, F.C.S., presented a paper bearing the above title; and from it we make the following extracts.

In his opening sentences, the author observes that water gas as a fuel is not well known in this country; and its claims on the attention of manufacturers have been somewhat sceptically received. On the Continent it is extensively used in several important works; and the various difficulties connected with rendering it a safe and cheap illuminant and an economical fuel are being rapidly overcome. That this is so, he shows by a description of what is being accomplished at the works of Messrs. Schultz, Knaudt, and Co., of Essen, where water gas is used for metallurgical purposes, and at the large works of Messrs. Pintsch and Co., at Fiorstenwalde, near Berlin, were water gas is employed for many purposes. The cost of water gas at the latter works, including all expenses, is equal to about 9d. per 1000 cubic feet; but if the bye-product of generator gas be taken into account, the cost is much less.

Alluding to the published assertions as to the dangers arising from the use of water gas led through a building in pipes, and to the suggestion that the recent cases of gas poisoning in Glasgow were due to the large percentage of carbonic oxide which the Corporation gas now contains, the author says: In one department of the works at Fiorstenwalde about 100 women were employed at glass blowing, the gas used in the blowpipes being water gas. So far as I could see, these workers did not suffer any more inconvenience from the use of water gas than would have been the case had ordinary coal gas been used. In order to prevent any escape from passing unnoticed, the gas is odorized by mercaptan; and it would have been impossible not to have detected it were it escaping, even in the most minute quantities, so strongly does it smell. To odorize the water gas, a small branch-pipe is taken off the main leading from the scrubbers, and passes into a vessel containing a 10 per cent. solution of mercaptan. Another pipe is led from this vessel to the main; and the gas which has become loaded with mercaptan, mixing again with the gas in the main, imparts to it a very strong odour. Odorizing the gas costs 8 pf. per 1000 cubic metres.

Referring to the use of water gas for lighting and heating, Mr. Ritchie states that, when the new water-works for the supply of Hamburg were laid down three years ago, the question of lighting and heating the numerous station houses for the filtering-beds and settling-basins, as also the lighting of the five miles of roads which intersect the works, had to be considered. Several methods for doing this were suggested. Lighting by electricity and heating the station houses by stoves were proposed; but, when the cost of the lighting, and the inconvenience and labour of the stoves necessary, were taken into account, this method was discarded. A supply of ordinary gas from the municipal gas-works might have been had, and used both for heating and lighting; but, according to calculations, the expense of this method would have been much greater than with water gas, and consequently it was discarded, and water-gas plant put down. In a paper on these water-works published last year, Mr. Meyer, the Engineer, writes thus of the suitability of water gas for such a purpose as the lighting and heating of the works: "This decision [to put down water-gas plant] having been arrived at, the erection of a water-gas plant in direct connection with the boilers of the Billwarder Islander intake pumping-station commended itself all the more because in that case the reciprocating action, well known to be advantageous between the steam-boilers and the gas-generators, could be utilized to the full."

Proceeding, the author claims that the entire absence of obnoxious naphthalene, and the diminished risks of explosion, are advantages in favour of water gas compared with ordinary gas. No danger can arise in the case of water gas if anyone should accidentally re-open a tap while extinguishing the gas, or if the wind should blow out a gas-flame outdoors, as the so-called magnesia combs attached to the burners will retain sufficient heat for some time after to relight the escaping gas. Mr. Ritchie here notices a very ingenious arrangement called the Porges burner, used to minimize the risk of poisoning with water gas. This burner will only admit of the passage of the gas while it is warm. When the gas has to be lighted, heat is applied to the burner, which causes a valve to open by the pressure of the vapour of benzol contained in a cavity allowing the gas to pass. Should the gas be blown out, the burner becomes cold, and the valve is tightly closed, and remains so until the burner is again heated.

It is significant (remarks the author in conclusion) that water gas should have been thought the best of the available methods of heating and lighting so important a place as the water-works of a town like Hamburg. Water gas was in use there during his visit for lighting the works, for heating the 96 pavilions

containing valves and sluices, as power in a crane (the engine of which is about 8 brake horse power), and for heating and cooking in the Engineer's private house. From what Mr. Ritchie saw of the application of water gas in Germany, he is of opinion that there is yet a large future in store for this form of gaseous fuel.

ACETYLENE.

A paper on this new illuminating agent was recently read, in Berlin, by Herr M. Hempel, of that city. It is printed *in extenso* in the *Journal für Gasbeleuchtung*, whence the following summary of its contents is made.

The constituents of coal gas are arranged into three groups, according to their value as illuminants or diluents, or their presence in the gas as undesirable impurities. Acetylene exists in coal gas, though scarcely to the extent of 0·1 per cent.; and it ranks high in the class of illuminants. It has a specific gravity of 0·91, and burns with a very bright but smoky flame. Only since the discovery by Willson of a method of producing it in a state of purity, on a large scale, has it advanced to the position of a practical illuminating agent. Calcium carbide is a compound of carbon and calcium which may be made in various ways. For instance, it is formed by strongly heating an alloy of zinc and calcium in contact with coal, or by the action of a powerful electric current on a mixture of lime or chalk and coal. It has a specific gravity of 2·262; is bluish or golden-brown in colour, and of metallic lustre; and, in odour, it resembles garlic. Acetylene is evolved when calcium carbide is brought into contact with water. There is no known solvent of calcium carbide; it is unacted on by hydrogen and nitrogen at all temperatures; at 245° C., chlorine forms with it calcium chloride and carbon; at 500° C., sulphur vapour acts on it to form calcium sulphide and carbon disulphide; arsenic and antimony are the only metals that attack it; and, in a stream of oxygen, it glows faintly, and calcium carbonate is formed. Steam is far less active than water towards it.

Practically, calcium carbide is now formed in the electric furnace from tolerably pure lime and coal. Acetylene is formed by merely allowing water to rise gradually in a vessel in which the carbide is exposed on grids. The gas needs no purification; and it is at once conveyed to the holder. Any sulphur in the coal used for the manufacture of the carbide, is retained in the form of calcium sulphide with the residual lime. It is evident that the apparatus needed for the production of acetylene is very limited and simple. Owing to its high density, acetylene must be supplied to the burner at about double the pressure at which coal gas is ordinarily burnt. Acetylene is liquid under considerable pressure. At 0° C., the liquid has a vapour tension of 21·5 atmospheres; and at 31° C. (88° Fahr.), 103 atmospheres. It is poisonous; but the smallest quantities are easily detected in air on account of its penetrating odour.

The following are some of the results of comparative tests of illuminating power and consumption of coal gas and acetylene in various burners. (The values are given in the original terms —*i.e.*, of the German candle, and should be multiplied by 1·05 to give approximately the values in English standard candles.)

Consumption and Illuminating Power with Various Burners.

Gas Used.	Burner.	Consumption per Hour.	Illuminating Power.	Candles per Cubic Foot.
		Cubic Feet.	Candles.	
Coal Gas .	Hollow-top . .	5·3	13	2·45
,,	Argand (ordinary)	5·65	16	2·83
,,	Siemens No. 4 .	7·05	33	4·68
,,	,, No. 2 .	21·2	130	6·13
,,	,, No. 00	84·75	650	7·67
,,	New Welsbach.	4·24	45	10·61
Acetylene .	Batswing No. 1	1·235	45	36·44
,,	,, No. 3	2·37	97	40·93
,,	,, No. 5	3·25	143	44·00

Like other heavy hydrocarbons and oil gas, acetylene needs a very powerful air supply in order to burn with a clear white flame. An external air supply is insufficient for its proper combustion in plain batswing burners; and, for the above trials, air was mixed with it in regulated proportion in the holder. The best results were obtained with two volumes of air to three volumes of acetylene. In special burners, however, acetylene may be burnt without previous admixture with air. Thus in an English rat-tail burner, it gave an illuminating power of 33 candles for an hourly consumption of 0·7 cubic foot. A consumption of 5 cubic feet an hour in a German-made Argand gave a value of 240 candles, or a duty of 48 candles per cubic foot of acetylene. The lighting value of acetylene is in this case nearly 20 times that of coal gas in a hollow-top burner, or 4·5 times that of the same gas in the Welsbach burner.

Notwithstanding its greater brilliancy, the acetylene flame is ar cooler than that of coal gas in a similar burner—partly on account of the lower proportion of hydrogen in acetylene, and partly on account of the lower rate of consumption. From calorimetric experiments by Dr. Bueb, of Dessau, acetylene appears to have a heating value of 407 calories per cubic foot; but the author, on theoretical grounds, reckons it should be about seven-eighths of this value. Light for light, the products of combustion are very much less from acetylene than from coal gas. From Dr. Poleck's analyses of Breslau coal gas, it would appear that it produces, on combustion, 1·3 times its volume of aqueous vapour, and 0·6 times its volume of carbonic acid. The corresponding figures for acetylene are one volume of aqueous vapour and two volumes of carbonic acid. For the production of 100 candles per hour in the Welsbach burner, 9·4 cubic feet of coal gas are required, furnishing on combustion 12·2 cubic feet of aqueous vapour, and 5·64 cubic feet of carbonic acid. The same lighting value is obtained from, on an average, 2·119 cubic feet of acetylene, producing its own volume of aqueous vapour, and 4·238 cubic feet of carbonic acid on combustion. Acetylene consumes a less quantity of air than coal gas in the production of a given amount of light. The coal gas needed for 100 candle-hours in the Welsbach burner requires about 56·5 cubic feet of air for its combustion; whereas the volume of acetylene that yields the same light requires only 26·5 cubic feet of air. The acetylene flame emits pure white light, and therefore shows objects in their natural colours; and it is also valuable to photographers. The maximum explosive force is obtained from acetylene when it is mixed with twelve times its volume of air. Coal gas requires only six times, and water gas only once, its volume of air for explosion.

Acetylene should provide a very practicable means of enriching coal gas. The following figures for its enriching power are taken from a diagram issued with the paper:—

Mixture of Acetylene and Coal Gas.

Percentage of Acetylene in Mixture.	Illuminating Power in Candles.
0	about 10
10	,, 12
16	,, 28
30	,, 58
64	,, 101
70	,, 126
73	,, 171
100	,, 240

The high density of acetylene would lead to stratification were it introduced into coal gas in the holder. It is therefore proposed to affix an apparatus for the production of acetylene to the outlet of each consumer's meter, and to supply a poor gas, which can be enriched by acetylene when it is needed for lighting purposes. A cheap gas would by this means be available for heating and driving engines. On the other hand, portable lamps containing sufficient carbide to produce acetylene for several hours' consumption can readily be constructed.

The *Chemiker Zeitung* makes the following comment on this paper: "The introduction of acetylene into the lighting industry is purely a question of cost. All the estimates of the cost of carbide—£3 to £4 per ton—hitherto made are incorrect. The carbide is actually only obtainable at a much higher price; and, therefore, its application to lighting still remains too expensive."

Received.—"The Principles of Rating Practically Considered, as they Affect the Assessment of Railways, Docks, Tramways, Gas and Water Works, Coal and other Mines, Electric Lighting Works, Manufactories, and other Hereditaments; with a Complete Digest of all the Important Cases, &c." By Edward Boyle, Barrister-at-Law, and G. Humphreys-Davies. Second edition. (London: W. Clowes and Sons, Limited.) This work will be noticed in an early issue.

The Impending Changes among Gas Managers.—Three of the vacant gas managerships recently advertised in the JOURNAL are likely to be filled this week—those at Wakefield, Tiverton, and Darwen. In all three cases, the "short lists" of selected candidates are to be interviewed. At Darwen, five applicants have been singled out from the 37 who sought the position vacated by Mr. T. Duxbury; and the final selection by the Gas Committee will be made to-morrow (Wednesday) afternoon, by or before which time the names of those chosen for the other two positions should be known.

North British Association of Gas Managers.—The Secretary of this Association (Mr. R. S. Carlow, of Arbroath) has issued the usual circular intimating that the Committee are making preparations for the approaching annual meeting, to be held on July 25 and 26, and inviting the co-operation of the members in maintaining the interest of these gatherings, from a technical point of view, by communicating some matter for consideration. As on previous occasions, a list of subjects suitable for discussion is submitted. They include the setting and heating of retorts; the economy of tar as fuel; the use of oils and tar for gas making; the purification and distribution of gas; internal fittings; burners; the supply of compressed gas; the comparative cost of gas, oil, and electricity for lighting purposes; prepayment meters; and the analysis of coal. There is plenty of scope here for selection. Of course, members will not be restricted to these subjects, but will be free to communicate notes of their practical experience in relation to any matter connected with the manufacture or distribution of gas and of their difficulties or successes therewith. The 23rd of June is the limit of time for sending in papers.

GAS POWER FOR THE PROPULSION OF BARGES.

Under the heading given above, a "Note" appeared on p. 479 of our issue for March 5; and as the matter referred to in it has excited some interest in Glasgow, a correspondent there sends the following particulars regarding the high-pressure portion of the work connected with the power supply to the gas-engine used in driving the barge in question, on the Seine, between Havre and Paris.

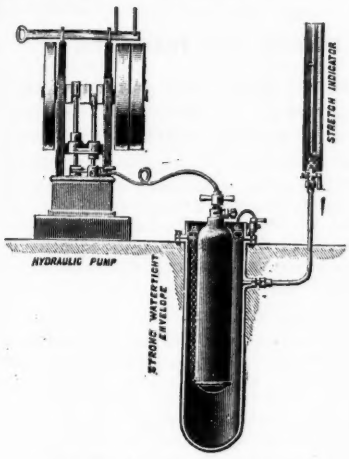


FIG. 1.—TESTING APPARATUS.

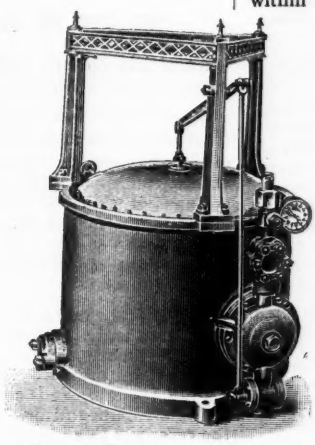


FIG. 2.—REGULATOR (24 INCH).

It is claimed that this portion of the mechanism really had its birth in Glasgow, in the works of the Scotch and Irish Oxygen Company, Limited, who, besides being manufacturers and compressors of high-pressure gases, have a large business in the construction of all classes of gas-fittings and machinery intended for working on the high-pressure principle. The Engineer and Manager of their works, Mr. Henry Brier, Mem. Inst. Mech. E., was for some years engaged in carrying on work for an English engineering firm at Rouen, Paris, and elsewhere in France; and amongst the personal friends whose acquaintance he made while residing there, were some of the very persons who are connected with this interesting enterprise of running barges on the Seine. On learning that they contemplated using gas-engines and highly-compressed gas for driving them, he invited a number of them to visit him at the Glasgow Oxygen Works, to see in operation the apparatus which he had devised and patented for use in the high-pressure gas industry. What they saw and heard from Mr. Brier on their visit determined them to take up the apparatus in question for their proposed new system of driving barges.

For the shore work of this undertaking, a set of pumps for compressing the gas was supplied by Mr. Brier's Company in Glasgow. These pumps are of the three-stage type, and are capable of working up to a pressure of 2000 lbs. per square inch, although at present they are only worked up to about one-half of this pressure. [It may here be mentioned that Mr. Brier went to France when all the apparatus was ready, and saw it properly installed, and in working order, before returning to Glasgow.] In respect of the cylinders in which the gas is compressed and stored, it is stated that the material used in their construction is mild steel of the very highest quality. The cylinders are 14 feet long and 9 inches in diameter. Their weight, however, is decidedly less than that stated in our issue of March 5, which was said to be 715 lbs. each, whereas the correct weight is only 490 lbs. per cylinder.

The expanding apparatus or pressure-reducing valve—which reduces the high-pressed gas down to a pressure proper and suitable for the engine on the barge—was made under the patents obtained by Mr. Brier, who also holds the patents for the testing machine employed for ascertaining the expansion and permanent stretch (if any) of the cylinders while being tested. This testing machine is represented in one of the accompanying illustrations, fig. 1. The reducing valve proper, or that portion of it which has to deal with the high-pressure gas, is fitted with a metallic bellows which, assisted by a set of toggle levers, is capable of reducing the pressure from 2000 lbs. down to $\frac{1}{4}$ lb. per square inch. Although sufficiently large to deliver gas for an engine of much greater power than the one in use on the Seine barge, this regulator, in order to meet the unequal and spasmodic demand for gas, is coupled up to a small bell-regulator, 2 feet in diameter, which forms a sort of storage for gas at low pressure, from which the engine can draw in the usual manner. Each portion of this reducing apparatus is self-acting; the bell being fitted with a rotating valve that closes its own supply and causes the bellows to check the high-pressure inlet. The starting valve, as will be seen, by reference to fig. 2, is situated between the regulator and the storage cylinders. These regulators are being supplied in modified forms for tramway engines driven by means of compressed gas; and in yet another very small size for tramcar and omnibus lighting by the use of compressed gas. In the latter case, as the act of compressing the gas, whether made from coal, shale, or oil, deprives it of much of its luminosity, the gas on being expanded through the regulator has a high degree of illuminating power imparted to it by passing it through benzoline.

The cylinder-testing apparatus already briefly referred to, and whose mode of action will be clearly understood from an examination of fig. 1, is employed to detect weakness in the gas storage cylinders, and to prevent them being over-strained during the process of testing. Its mode of working is as follows: The cylinder to be tested is filled with water, and is then placed within a strong waterproof envelope, which is also filled with water to the exclusion of all air. A perfect joint is made round the shoulder of the cylinder or its neck (preferably the latter), by inflating the rubber surfaces of the annular cover-ring. This can be done instantaneously by water pressure from the main or any other suitable source. On subjecting the cylinder to hydraulic pressure, its expansion is measured by the displacement of water from the envelope, which immediately commences to rise in the gauge glass, and continues to do so until the maximum pressure is reached, on release of which, in the case of good cylinders, it falls to its original position. In this way, it is shown that the elastic limit of the metal has not been passed, and that the cylinder has in no way been damaged. An application of water pressure under such conditions to a cylinder after it has been carefully annealed, gives a perfect insight into the behaviour of the metal while it is undergoing the test, and makes it quite possible to discover such cylinders as are in the least degree faulty—all of which are at once consigned to the scrap heap.

Chemical Process for the Purification of Waters.—MM. Boardas and Girard employ, for the purification of water, calcium permanganate, which removes organic matter and all micro-organisms. The reactions are: Decomposition of the calcium permanganate in presence of organic matter, with formation of calcium carbonate and manganese oxides; oxidation in the mass (composed of coke and manganese oxide) of the lower oxides of manganese at the expense of the excess of calcium peroxide; lastly, slow reduction of the manganese peroxide thus formed by the organic matters, or by the coke itself.

The Advance in the Price of Oil.—Writing from Philadelphia on the 13th inst., *The Times* Correspondent said: "The remarkable rise in the price of petroleum has caused great excitement in the Pennsylvania and Ohio oil-fields. Two years ago, oil was 53c. a barrel. Last January, it was $1; and since then it has been advancing rapidly, until in the course of last week it touched $2, and closed on Saturday at $1 99c. The increased demand for oil, caused by the exhaustion of their stock, recently led the Standard Oil Company (which mainly controls the output) to advance the price. This has caused increased prospecting for oil. In the Pennsylvania and Ohio oil-fields, 1500 new pipe wells have been sunk; while dynamite has been exploded in the old wells with a view to increasing the flow." The Directors of Scotch oil companies met privately last Wednesday in Glasgow to consider the continued rise in American and Russian prices. After a prolonged meeting, it was agreed to raise the price of burning oil 2d. per gallon, which is equivalent to £70,000 to £80,000 increased revenue. On the previous day, the Scotch oil companies raised the price 1d. per gallon; making a total increase of 3d. per gallon in one week. The Scotch output is estimated at 12 million gallons.

The Cost of Electric Lighting in America.—The Committee on data for the National Electric Light Association have lately reported the results of their investigation into the cost of electric lighting, as ascertained from returns received from 24 stations, at all of which coal was used for fuel; and the following particulars are given in the *Engineering Record*. The highest economy was obtained from a plant equipped with triple-expansion engines with the dynamo on the engine shaft, horizontal water-tube boilers, with heaters, without economizers, and with hand-fed fires. Using one-half each soft coal and hard screenings, 262 watts were generated per pound of coal. An examination of the report proves it to be a high average for 24 hours, as with an evaporation of 9·37 lbs. of water per pound of combustible, and a water consumption of 17 lbs. per horse power, allowing 10 per cent. non-combustible in the coal, and taking the efficiency of the generators at 85 per cent., we have $(9{\cdot}37 \times 0{\cdot}90) \div 17 \times 746 \times 0{\cdot}85 = 314$ watts produced from 1 lb. of coal. This average is stated to be much nearer the theoretical efficiency of a modern steam plant than any report previously received by the Committee. Taking an average of the ten reports from stations generating more than 5,000,000 watts in 24 hours, we have 147·5 watts per pound of coal, or a production of one electrical horse power for 4 lbs. of coal on a basis of the efficiency of the generating machinery as stated in the last report of the Committee.

HEATING BOTTLING-ROOMS AND BREWERS' CELLARS.

In a "Note" in the JOURNAL for Feb. 26, we gave some particulars in regard to a system, devised by Messrs. Fletcher, Russell, and Co., Limited, for heating the bottling-room at the Warrington Brewery by gas. The result of the publication of those particulars has been several requests to Mr. T. Fletcher, F.C.S., to take up the subject more completely, and deal with the whole matter, not only as regards gas, but also with reference to other available fuels and systems. He has done so, and has published his views thereon, from which we make the following extracts:—

Mr. Fletcher is of opinion that, for the heating of bottling-rooms and brewers' cellars, two systems are absolutely necessary—one by which perfect precision can be obtained in rooms where fermentation is carried on; the other, for general stores, where slight variations are of less importance than economy of fuel. In the first case, the power of adjusting the temperature easily, within 1° Fahr., is the first consideration; and this is only possible with gas, burnt in ordinary lighting-jets, as they require at times to be turned down far lower than is possible with any atmospheric burner. As the heat is required more especially at the floor-level, it is necessary that not only shall the burners be located as near the floor as possible, but also they must be so placed as to cause a rapid and equal circulation of the whole of the air in the room. This can only be done by fixing the burners in one or more parallel rows, along the room, from end to end. Gaps may be allowed at intervals, with sloping blocks on each side of the gas-pipe, to admit of trucks, &c., passing; but no deviation can be permitted from the straight line of flames, which may be placed either down the middle, or at one or both sides of the room. A row of burners across the room in any part will cause irregular eddies in the air currents, and great local variations in temperature. A good gas-pressure governor on the main is necessary. The whole series of burners must be controlled by one gas-tap, having a quadrant and pointer, to admit of very minute adjustment. This tap should be placed in the most convenient position, with a good thermometer close beside it; and, as a rule, some adjustment of the tap will be needed about three times during the 24 hours, if the variation is to be kept within 1° Fahr. The number of burners required, and their cost, are easily calculated. It has been found by experience that from 75 to 87½ per cent. of the total heat is absorbed by the walls and ceiling; the remainder going to heat the air and the contents of the room. As the ceiling always bears a relation to the wall area, it may be omitted from the calculation, and only the wall area considered. For every 1600 square feet of wall surface, a gas consumption of 1 cubic foot per hour is required to maintain a rise of 1° Fahr. over the normal. Therefore, if provision is made for a minimum of 20° Fahr. outside, in the severest weather, and 58° Fahr. is required inside, the gas consumption to maintain this rise of 38° will be 38 cubic feet per hour for every 1600 square feet of wall surface. Using burners consuming about 3 cubic feet per hour each at 10-10ths pressure, the number required to provide for the heaviest ordinary winter work may be readily ascertained. In very abnormal weather, such as that experienced last winter, it may perhaps be necessary to change some of the burners for the next larger size; but this is a very simple matter, and may possibly not be needed for the next twenty years.

Of all safe methods of heating on a large scale, Mr. Fletcher considers that the cheapest, and by far the most satisfactory, is the use of live steam from the works boiler. The simplest and best method is to blow the steam into ordinary 4-inch hot-water pipes, placing traps in all parts where the pipes dip, to get rid of the condensed water. As to the location of the pipes, the proper thing is to sink them in recesses along the floor, covering them over with grids. Allowing 25 per cent. loss of fuel in converting water into steam, it has been found in practice that 1 lb. of good coal or coke burnt per hour under a good boiler evolves sufficient heat to keep 22 feet run of 4-inch pipe at an average temperature of 180° Fahr.; and this length of pipe will maintain a rise of temperature of 14° Fahr. in a room with 1600 square feet of wall surface. Therefore for this space, to maintain a rise of 38° in severe weather, 60 feet run of pipe will be required; necessitating an extra fuel consumption in the boiler of 2·73 lbs. per hour, or 1·7 lbs. per hour for every 1000 square feet of wall. The cost in this case, after the first expense of laying the pipes, will be very little, if any, in excess of coke burnt in braziers; and it has been found that, with the pipes laid in straight parallel lines, like the gas-burners, with a steam-valve and thermometer arranged in the same manner as with gas, the average temperature can be kept, in practice, within 3° to 4° variation from the required mean. The calculation of the actual working cost in practice, for any temperature, must be based on the mean temperature of the outside air. If a steady 57·5° Fahr. is required, the mean temperature at Greenwich is sufficiently high, from May to September inclusive, to require little artificial heat. The seven months from October to April—212 days—in the latitude of Greenwich, have a mean temperature of 44·5° Fahr.; and therefore an average additional heat of 13° will be required for this period, and any other required temperature can be worked out in the same way. Taking the room with 1600 square feet of wall surface as a basis, the average gas consumption for the 212 days will be 13 cubic feet per hour to maintain a steady temperature of 57·5° Fahr.; while the consumption of steam, where this is used, will be readily found by the same method.

Mr. Fletcher points out, in conclusion, that the calculations based on the wall surface are for cellars with low ceilings, from 8 to 10 feet high, such as are ordinarily used for stores and conditioning; and that for loftier rooms the cost does not increase in proportion.

THE USE OF GAS-ENGINES FOR TRAMWAYS.

An article on this subject appeared in the Journal of the Association of Austrian Engineers and Architects, and has been reprinted in the *Gastechniker*. Of the many systems of gas-motor tramways, three are selected for detailed description on account of their having been tried with success or of their giving promise of being adopted. These are the Daimler, Lührig, and Connelly systems, of which the second has been described at some length in the JOURNAL.* The portion of the above-mentioned article which treats of the Lührig system is, therefore, not dealt with in the following abstract translation.

The Daimler Motor System.

The Daimler motor is a gas-engine for which the requisite gas is automatically produced from petroleum of 0·68 to 0·70 specific gravity—that is, from so-called "benzine." The impetus is given by the pressure exerted on the upper surface of a piston on the ignition, and consequent combustion of a mixture of benzine vapour and air. The benzine for the purpose is led from the reservoir to a chamber which serves to supply two burners, and to the gas-making apparatus, which is provided with a float. The burners are placed in front of the engine, in lanterns which protect them from external influences. Air is warmed in the upper parts of these lanterns; and it passes thence by a pipe into the gas-making apparatus, in which it vaporizes the benzine. The piston in its down-stroke draws this gas, and at the same time a fixed quantity of air, into the combustion chamber above the cylinder. The gaseous mixture so produced is compressed on the up-stroke of the piston, and ignited by a small platinum tube heated by the flame of the burner. The resulting explosion and expansion of the mixture, drives the piston down in the cylinder, and makes the working stroke. At the succeeding up-stroke, the products of combustion are driven out through a tube; and with the next down-stroke, the cycle of operations commences afresh. The crank-shaft thus makes two revolutions before an explosion takes place, or before the piston makes a working stroke. The upper part of the cylinder—the combustion chamber—is cooled by water, to prevent the heat disengaged by the combustion making it too hot.

The maximum speed of this engine is 560 revolutions per minute. In order to make it to a certain extent independent of the variableness of the resisting forces, a sensitive governor is affixed to the engine. It requires two to four minutes to start the motor; but after the burners are lit, and the small platinum tube is red hot, only a few turns of the crank-handle on the fly-wheel are necessary to set the engine going. The average consumption of oil in the Daimler motor is 1·06 pints per horse power per hour, corresponding to a cost of about 2d. Up to the present, there have been constructed with this gas-motor, trolleys, single cars, and locomotives both for tram and railways. The trolleys were built for gauges of 2 to 4·7 feet. The platform of the trolley supports two transverse benches, each seating three persons; while boxed in in the middle of the platform is a two horse-power gas-engine, alongside which there is room for the driver. A sufficient supply of benzine can be carried for a four or five hours' run; but the cooling water must be changed about every hour. The trolley travels, in either direction, at a maximum speed of 13 miles per hour; and it is equipped with a powerful hand-brake, a tool box, and the necessary implements. These trolleys for standard gauge cost nearly £200, and weigh 16¾ cwt.; while for gauges of 1 metre (39·37 inches) and 2 feet the prices and weights are respectively £190 and £185, and 16 cwt. and 14¾ cwt.

The following are the results of a trial trip undertaken by Professor J. Zemann, formerly Editor of *Dinglers Journal*, with a trolley constructed for use on a one-metre track in South America. The trial was made on a track which, from the horizontal, proceeded to a rise of 2·88 in 100, and finally to one, 55 yards in length, of 3·05 in 100. Notwithstanding that the rails were damp on the day of the trial, the trolley traversed the course without difficulty, and on the last run, with a load of eight persons, or a total weight of 11½ cwt. With this load, it could be started, though slowly, when at a standstill half-way up the rise.

The engine may be either at one end or in the middle of a Daimler-motor car. In the former case, the power is transmitted by cog-wheels from the engine-shaft to the nearest axle of the car; in the latter case, by cog and chain gearing to both axles. The putting in and out of gear, and the change from one to the other of the two possible speeds—5 and 11 miles per

* See JOURNAL, Vol. LXIII., p. 152, and Vol. LXV., p. 22.

hour—are effected by the manipulation of one lever. The gearing by which these ends are attained is ingenious and tolerably simple. The benzine is carried in special vessels, and conveyed to the engine by means of a pump. The cooling water is stored either in pipes under the platform of the car, or in a reservoir above the engine.

The larger cars constructed for the Wurtemburg State Railway Trust for draught purposes on the Saulgau-Herbertingen-Ridlingen section deserve especial mention, as they have given very satisfactory results. Equipped with a six horse-power motor, these cars weigh 63 cwt., and have ten seats and standing room for ten people. In a trial between Esslingen and Plochingen—a distance of 5·6 miles, of which 1¼ miles was on the ascent, the remainder being level—a car loaded with fifteen people traversed the double journey in 71 minutes, or maintained an average speed of 9½ miles per hour. The oil consumption averaged 0·46 lb. per mile. The smaller cars fitted with two to three horse-power engines were of the waggonette type—*i.e.*, without closed sides and with only a light roof. The engine is, as a rule, at the rear of the car. These cars are specially valuable for occasional temporary use for passenger traffic. The seats may be arranged either longitudinally or transversely; and the tractive power of the engine is such that, on a level road, an extra car for twelve persons can be attached. The cars only run forwards, and have to be turned round for the return journey. Such a car for the one-metre gauge, and with transverse seats for twelve people, and standing room for three or four, would weigh (empty) 17 cwt., and would cost about £225. Tram-cars on similar lines, but with the Daimler 4 horse-power motor placed in the middle of the car, have been constructed with seats for eighteen and standing room for six people. The two cylinders of the motor in this car are inclined towards one another; and the pistons work on a common crank-pin. This serves as the connection to the fly-wheel, which is surrounded by a circular-shaped casing.

Narrow-gauge Daimler locomotives are peculiarly adapted for use on lines that are only worked during part of the day. They are free from smoke and smell; and so they are specially useful for passenger traffic in towns, and for communication between different suburbs. They have advantages over steam-engines for lines with little traffic, as they can be put into readiness for starting in three minutes, and only require one attendant. The motor is in the middle of the car; and the power is transmitted to both axles, and there is a choice of three speeds—3, 5½, and 10 miles per hour. There is a duplicated system of levers, so that the driver may work from either end of the locomotive, according to the direction in which it is travelling. A supply of benzine sufficient for 10 to 12 hours' working can be carried; but in continuous work the cooling water, which circulates through pipes on the roof, must be changed more often. There is a hand-brake acting on both axles. A six horse-power Daimler locomotive for the one-metre track costs £385, weighs 2½ tons and has a tractive power when running on a perfectly level road of nearly 14 tons.

The Connelly Motor System.

The Connelly tramway locomotive is 11 feet long, and has a wheel-base of 5½ feet. The two-cylinder engine stands in a vertical position in the middle of the base, and gives 12 to 14 effective horse-power. Directly above it, beneath the roof, is the cylindrical oil reservoir, surrounded by a second cylinder. Into the space between the walls of the two cylinders, the water from the cooling jackets of the engine cylinders is forced by a rotatory pump. It has a temperature of about 110° Fahr., and imparts sufficient heat to the petroleum to convert it into gas. The water flows subsequently into pipes beneath the car, where it becomes sufficiently cooled for use again. A small dynamo attached to the engine serves to ignite the gas-charges, and also for lighting the cars. The locomotive weighs 4½ tons.

The chief characteristic of the Connelly locomotives is the method of transmitting the power from the motor to the driving-wheel. This permits variation in pace, according to the working requirements, with the maintenance of a uniform speed of the engine. The method is based on the use of friction-blocks, and allows the control of the speed of the locomotive and its stopping and starting by the movement of two levers. Another lever determines the direction in which it travels. From trials, the Connelly locomotive appears to work quietly and reliably, and to require but slight attention.

These locomotives have been in use for some time on the lines in the outer suburbs of Chicago; and the results have been so favourable that the Tramway Board intend to adopt them in place of horses wherever practicable. Those already in use employ the ordinary illuminating gas for driving their engines, and carry sufficient for three hours' work. Their consumption of gas averages 13·2 cubic feet per mile; and the re-charging occupies only one minute. The locomotives in question are able to negotiate rises of 2 in 100 with two cars carrying 52 people, or rises of 5 in 100 with one fully loaded car. The trials of Connelly locomotives on the Bermondsey line of the Greenwich and Deptford Tramway Company, London, showed in seven days of 14 hours a consumption of about 70 gallons of oil. This sufficed to make 350 journeys averaging 1·45 miles, and for the conveyance of 4182 people. The working expenses in this particular case amounted to about 2d. per mile run.

CORRESPONDENCE.

[*We are not responsible for the opinions expressed by correspondents.*]

The "Workman-Director" Question.

SIR,—So much has happened, and been commented on, in the JOURNAL since its issue of the 19th of March, which reached me in Madeira (my visit to that island had nothing to do with the state of my health), that I hope you will allow me space to deal with what has taken place in the interval.

First, with regard to Mr. Livesey's letter of the 22nd of March. I have not "shifted my ground" as to false steps. The second was taken at the general meeting, and was the corollary of the first—viz., his introduction of the wild scheme of hermaphroditic representation, which was rejected in the Board-room. He has now added a third false step, by inducing Mr. Mundella to ask the House of Commons, by means of an "Instruction" to the Committee on the Bill, to give the go-by to his Board, to nullify their decision, and by a side-wind to carry the policy of their "legal head" as you dub him. I have never before heard such a designation applied to the Director who is selected by his colleagues to preside over their deliberations, and to be their public mouthpiece, but not to dragoon them, and override their deliberately expressed convictions. A "gas specialist" is no more—probably less—fitted than any other Director, possessing reason and common sense, to consider and decide on what is a constitutional and not a manufacturing question.

This sort of one-man power, and the hyper-aggrandisement of Chairmen of Boards of Directors, is a very dangerous state of things to import into the management of Gas Companies or, indeed, of any Companies. In the Railway world, it is known as "Watkinism," and has in the recent past almost, if not entirely, ceased to exist among Railway Chairmen.

Having known well, for many years, the eminent members of the Labour Commission whose views Mr. Livesey quotes, I can quite understand their desire that experiments in profit-sharing, and what it is contended arises out of it, should be made. What I demur to is that a Company in which I am interested, and whose operations are distinctly defined by a series of Special and General Acts of Parliament, should be made the *vile corpus* on which such an illogical, inconsistent, and paradoxical experiment as that of the "workman-director" scheme should be tried—especially when the majority of the Directors have decided against it. Fortunately, the accident (not unforeseen by many who had studied the measure) to the South Metropolitan Company's Bill, has prevented the chance of the scheme suggested by the "Instruction" being rushed through without the full knowledge of all concerned. Time will now be afforded for full consideration by the shareholders of the question in all its aspects, including the logical absurdity of investing a Director with antithetical functions.

Mr. Livesey says that, in a few years, all the regular employees of his Company will be shareholders, "who may reasonably look for some control over their property." Surely, Sir, they will have exactly the same control as—neither more nor less than—their fellow shareholders. Why should he seek to isolate them, and make them a special class of shareholders, with special representation on the Board *quâ* shareholders, as he has expressly stated that they are not to be represented *quâ* labour *per se?* What possible reason can there be for splitting up the proprietary body into classes, and assigning to one of such classes a special representation on the Board? Had the "Instruction" to the Committee on the Bill been considered, and dissected by Counsel for the opponents, I feel certain that the clause would never have been inserted; and I hope that if ever the scheme is resuscitated, and forms part of a Bill, those who are opposed to it will petition against the Bill, and instruct Counsel to represent them.

Mr. Livesey says: "The labour question is not yet settled." No, nor ever will be. Strikes, like wars, are stern necessities—imposed from time to time by the perplexing conditions of this imperfect world. Capital and Labour are both in the nature of commodities, the values of which are constantly varying according to the supply and demand. Arbitration is an excellent substitute for striking, and most valuable or arriving at an agreement; but it cannot be made compulsory, and nothing but "mutual consent" can either establish arbitration or fix the rate of wages. Profit-sharing and co-operation are not cures for labour disputes, though they are interesting and valuable phases of the industrial machinery of productive organizations. If the labourers are "led astray by ignorant and misguided men," nothing but the bitter experience of the folly of their leaders will bring them back into the right way. Strikes have, in relation to our industry, sometimes proved blessings in disguise. But for the action of the coal-porters at the time of the dock strike, and their threats of striking, we should never (or certainly not for a long time) have adopted the use of unloading and conveying machinery, which has so greatly reduced the cost of handling coal and—unfortunately for the men—largely reduced the number of them required for that work. Mr. Livesey says that my "experience at Horseferry Road during the last five years has not been of growth, but of standing still, or rather of going back." That may be his opinion; but as the charge is extremely vague, and does not seem to have been endorsed by The Gaslight Company's shareholders, I can afford to let it pass.

With regard to the system of profit-sharing, as established in the South Metropolitan Company, it is not so much knowledge in regard to it of which I am deficient, but of faith in its possessing the benefits claimed for it. But I will admit that I am a little puzzled by the various explanations of the plan. You on the 9th of April (p. 740) contend that, in profit-sharing, the "profit belongs to the employer, and to him alone. If he is disposed to give a portion of it to his employees, it must be in addition to their normal rate of wages." Now what Mr. Mundella (who spoke for Mr. Livesey in the House of Commons) says, appears to be quite different: "All that is necessary is to include them in the partnership, by providing that a certain percentage of their salaries and wages shall be paid for every reduction of 1d. per 1000 cubic feet, and taking off this percentage when the price rises."

Now are we to assume that, in the case of the South Metropolitan

Company, the wages paid are at the standard rates paid by the Metropolitan Gas Companies generally, *and include or exclude* the bonus money? If it is included, there is no money advantage to the profit-sharing workman; while if it be excluded, the Company are—unless the bonus money comes entirely out of the earned but undivided statutory dividend—mulcting the consumer of a portion of his share of profits in the shape of possible reduction of price. If the first hypothesis were correct, the scheme as regards the men would be transparent humbug, as they would gain nothing under it. If the alternative be the fact, it is an amiable fad if the bonus is out of the dividend fund, and an evasion of the sliding-scale regulations if out of the general profits. As I before stated, if employees desire to invest a portion of their wages in the stock of a Company, I think that, as far as it can be legally done, the necessary facilities should be afforded them. But I cannot regard the policy of throwing "a sop to Cerberus" in the shape of a bonus beyond the standard rate of wages, as worthy of imitation. I do not consider Trades Unionism such a terrible monster that it should be coaxed or bribed out of existence. As long as the Unions keep within the limits of the law, I do not see how exception can be taken to their operation. When they evade or go beyond the law, the power of the Courts is quite strong enough to bring them to book. However, as the South Metropolitan Company have instituted their profit-sharing scheme, we can well wait and watch its operation, the most interesting development of which will be reached when, if ever, the necessity arises of reversing its present operation—consequent on a reduction of dividend from an increased price of gas.

I must apologise for the length of this letter; but as you said that it was desirable that the arguments on both sides should be fully stated, I have not aimed at too great condensation.

WM. THOS. MAKINS.

1, *Lowther Gardens, Prince's Gate, S.W.*,
April 11, 1895.

P.S.—Since writing the above, I have seen in the JOURNAL for the 16th inst., Mr. Ewart's letter on "The Workman-Director Question;" and, though I do not adopt his *argumentum ad hominem*, I entirely agree in his view of the question—viz., that, while it is quite competent to private employers of labour, or to partners who are the directors of private companies, to try any experiment they please, which may be dictated by their socialistic ideas, philanthropic impulses, or political predilections, the position of directors of public statutory companies is quite different, and imposes upon them as trustees for their general shareholders, the duty of avoiding indulgence in personal crotchets, and abnormal schemes for altering the constitutional government of the undertakings of which they are in fiduciary charge. Individual prepossessions in favour of change for the sake of change, or when no overwhelming necessity has arisen to call for such revolutions, should not be indulged in by responsible directors; and any departure from the recognized and authorized practice in regard to the constitutional representation of the shareholders on the board of directors should be resisted.—W.T.M.

SIR,—I will not waste your space, or try your readers' patience, by again going over the ground to prove the incorrectness of Colonel Makins's repeated assertion that, in asking for an "expression of opinion" on workmen-directors at our Wharncliffe meeting, I was not the mouthpiece of the whole Board. It is not by such side-issues that the question will either be advanced or retarded. In fact, it has got beyond them; for, as one result of the opposition at the meeting, the House of Commons, on the motion of two past Presidents (Mr. Mundella and Sir Michael Hicks-Beach), supported by the President of the Board of Trade (Mr. Bryce), without a dissentient voice or a discordant note, has approved of the proposal.

With the main part of Colonel Makins's letter, I can make short work. He speaks of the "logical difficulty," the "initial difficulty," the "*reductio ad absurdum*"—nay, the "impossibility of the same person discharging the double and conflicting functions of master and servant, employer and employed, director and directed." His argument is: The thing is illogical, absurd, impossible; it never has been, and therefore cannot be, done. Well, it has been done. It is now, and has been for years, in satisfactory operation in a goodly number of successful manufacturing concerns in this country; and, so far from causing difficulties, it removes them, for, as a matter of course, the workmen render more intelligent and willing obedience to the rules and regulations they have helped to make, and to the representatives of that authority which they themselves have had a hand in establishing.

GEORGE LIVESEY.

Reigate, April 17, 1895.

SIR,—I am sorry that my form of argument does not commend itself to you. I was under the impression that your paper was owned by a limited company; and that, therefore, some form of profit-sharing might be applicable to it. The cases are, however, scarcely parallel; so that it is perhaps unfair to use you to illustrate the motive of my letter—viz., that the workman-director is really entirely a question for the Board and shareholders of the South Metropolitan Gas Company, as the consequences of success or failure must necessarily fall upon them.

I attach, therefore, very little importance to the "Instructions" or views of Members of Parliament or other irresponsible persons on this question, who, without serious consideration, are ready to vote at a moment's notice for its being carried out at some one else's risk, though some of them, at any rate, are in a position to make the experiment for themselves in concerns with which they are connected, but have not yet got even the length of profit-sharing.

I do not think there is any useful purpose to be served by my expounding my views on the workman-director in the JOURNAL; for little fresh light has been thrown upon it since our shareholders' meeting in February. Besides, there appears to be a tendency in newspaper correspondence to drift away from the subject into the bye-paths of personalities. Most of your readers must, I think, be heartily tired of the workman-director. He is dead now, and will be buried, I hope, as soon as possible.

JOHN EWART.

4, *Fenchurch Street, E.C., April* 18, 1895.

Heating Greenhouses by Gas.

SIR,—Many conflicting statements have been made as to the cost of the above method of heating, none of these giving the exact duty obtained; and with the object of setting the matter in such a form that there need be no future doubt or discussion, a series of exact observations have been made with every possible care. The results are—

Date.	Mean Outside Temperature. Deg. Fahr.	Mean Inside Temperature. Deg. Fahr.	Rise. Deg. Fahr.	Gas Consumed. Cub. Ft.	Gas per Hour. Cub. Ft.
Jan. 4 to 10	26	49	23	2630	15¾
„ 11 „ 17	44	54	10	1370	8¼
„ 18 „ 24	38	52	14	1580	9½
„ 25 „ 31	36	54	18	1570	9½
Feb. 1 „ 7	43	55	12	1380	8¼
„ 8 „ 14	37	55	18	1470	8¾
„ 15 „ 21	35	54	19	1540	9¼
„ 22 „ 28	39	55	16	1160	7

The house is a lean-to, 16 feet by 10 feet, 12 feet high at back, 6 feet at front. The total area of glass is 380 square feet, including wood framing. It will be noted, in calculating out each of the above separately, that the gas consumption varies; this difference being caused by the varying force of the wind.

Though the figures given are only to the end of February, they have been continued since; but as the sun-heat makes the records so irregular, they have been discarded. Taking the average results for the eight complete weeks, it will be found that for every 100 square feet of glass a gas consumption of 1 cubic foot per hour will give a rise of exactly 4⅓° Fahr., or 1° Fahr. rise of temperature for every cubic foot per hour consumed in a house having 450 square feet of glass exposed—a rule which, from the care which has been taken to obtain absolute precision, may be relied upon. As the main wall is part of a dwelling-house, the loss on this side will not need consideration. An attempt has been made to take the night averages only after Feb. 28; but the interference by accumulated sun-heat during the day has caused sufficient variation to prevent the results being absolutely reliable, though they correspond fairly with the results recorded. As previous experiments have proved, at least nine-tenths of the heat is lost through the glass; and the cubical contents of the building need no consideration. The brickwork round is 3 feet high—being in the usual proportion; and the loss of heat through the bricks is allowed for in calculating the glass area.

Position, protection from winds, and other interfering conditions, will, of course, affect the results; but the above may, I think, be taken as an average standard for calculation. The average mean temperatures for each month may be obtained from the gardening periodicals, or from any physical atlas; and the actual cost of heating any plant-house by gas can easily be calculated from the data given.

THOS. FLETCHER, F.C.S.

Warrington, April 17, 1895.

A Laboratory Burner for Oil Gas.

Writing with reference to the paragraph on the above subject in the last number of the JOURNAL (p. 796), Mr. T. Fletcher, F.C.S., says: "I have made, and sold, for twenty years past, atmospheric and blast burners of every kind, and for every purpose, working with the ordinary pressure at which this gas is used for lighting—*i.e.*, from 5-10ths to 6-10ths. That Herr Spüller should have succeeded in making *one* pattern of burner only, requiring five times the usual gas pressure, and readjustment every time the gas supply is increased or diminished, is not a feat worthy of international renown. Ten years ago I could have supplied Herr Spüller with at least a hundred different patterns of burners for oil gas of any quality, working under ordinary pressures, and requiring no constant readjustment. My present firm can produce a still larger variety, perfectly suited for gas of any quality or composition. Anyone interested in this matter has only to go into the kitchen of one of the Midland Railway Company's dining saloons to see them working on a fairly large scale. These burners were designed, and their proportions calculated, to suit the composition of the gas used. They were never tried with gas until they were put into practical work; and they did not need the slightest adjustment. Burners of this class are matters of ordinary commerce."

The Letting on Hire of Gas Cooking-Stoves at Oldham.—The Oldham Corporation Gas Committee recently decided to let out cooking stoves on hire, and selected three makers—Messrs. Fletcher, Russell, and Co., Limited, J. Wright and Co., Limited, and Richmond and Co., Limited—to supply them. An exhibition, promoted by the last-named firm, was opened in the town on Tuesday, and has been very successful. It is being continued another week.

Extensions at the Matlock Bath Gas-Works.—In consequence of the rapid increase in the consumption of gas, the Matlock Bath Gas Company have found it necessary to at once extend their storage capacity. They have therefore let a contract to Messrs. R. Dempster and Sons, Limited, of Elland, for a steel tank, 64 feet in diameter, with holder prepared for telescoping, the whole of the tank to be above ground. The work is being carried out to the specifications of the Company's Manager (Mr. A. W. Elton).

Bombay Gas Company, Limited.—In the report of the Directors of this Company for the year ended Dec. 31, they state that, as compared with the preceding year, the increase in the revenue is £4032, of which the gas and meter rental contributed £3789. A considerable saving has also been effected in expenditure, especially in the coal carbonized, chiefly due to lower freights. The loss by exchange is greater by £5025; but the whole amount for the year—£25,132 16s. 8d.—has been written off revenue. The profit, with £1404 brought forward, is £18,343 9s. 8d. After deducting the interim dividend paid in December last (£7200), the balance available is £11,143 9s. 8d., of which the Directors have placed £2000 to the reserve fund; and they recommend a dividend of 3½ per cent. for the half year, making 6½ per cent. for the year, and leaving £743 9s. 8d. to be carried forward. A renewal of the contract for lighting the public lamps is being negotiated with the Municipality; and the Directors hope it will be satisfactorily arranged.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF COMMONS COMMITTEE.

Thursday, March 14.

(*Before Sir* J. KITSON, *Chairman; Mr.* WICKHAM, *Mr.* WROUGHTON, *and Mr.* S. H. WHITBREAD.)

WHITBY WATER BILL.

This Bill, which is to sanction certain works constructed by the Whitby Water-Works Company, and expenditure connected therewith; to authorize the Company to raise additional capital (£12,000, with £3000 borrowing powers), subject to the auction clauses; to construct works, and to obtain an additional supply of water, and for other purposes, came before the Committee to-day. It was opposed by the Whitby District Council and by Messrs. Foster, whose property was affected.

Mr. LITTLER, Q.C., and Mr. CLAUDE BAGGALLAY appeared for the promoters; Mr. PEMBROKE STEPHENS, Q.C., and Mr. J. D. FITZGERALD, for the District Council; and Mr. BALFOUR BROWNE, Q.C., and Mr. LEWIS COWARD for Messrs. Foster.

Mr. LITTLER, in opening the case for the promoters, sketched the past history of the Company since its formation in 1864, and described the relations existing between them and Messrs. Foster, of whom they had rented the user of land at Hazelhead and Randymere for the collection and storage of water, and which had yielded 97,000 gallons per day for Whitby. These works, however, on extending the supply to the new portion of the town, were found to be inadequate; and, beyond that, there had been irregularity in extending the water-collecting district outside what their parliamentary powers originally authorized. It was for these reasons that the Company now sought fresh parliamentary powers; so that they might be better able to provide a supply more adequate to the needs of Whitby. They proposed also to place themselves in a position to purchase from Messrs. Foster whatever they had to sell—whether right of land at Randymere or easements of pipes used for purposes of the supply, and, if they failed to agree, the difference was to be referred to arbitrators. The Company were prepared to pay everything which the arbitration might say was reasonably due to Messrs. Foster. As to the objection of the District Council, the Company had always done their best for the town, and were desirous of continuing to do it. The present application was made in the interests of the town, as Messrs. Foster, in their petition, were willing to sell at "a reasonable and proper price;" and the Company were willing to purchase at "a reasonable and proper price." It was a matter for arbitration rather than for the Committee, who would not take upon themselves the duties of arbitrators. The capital now asked for would, in addition to the existing powers, bring up the total available capital to £27,500; and the proposed water supply would provide for some 25 per cent. above the present population of the town.

Mr. *J. Mansergh*, M.Inst.C.E., said he had advised the works for which provision was made in the Bill. He believed them to be necessary to enable the present works to be fully utilized, and to stop the extensive leakage from the reservoir. He considered it most undesirable that the water supply should be subject in any way to the control of private owners, who, under the existing agreements, might turn the Company out at three years' notice, though the Company had no like power of releasing themselves. This was not a proper basis upon which the water supply of an urban population should rest.

Friday, March 15.

Mr. *Mansergh*, in cross-examination by Mr. FITZGERALD, said he intended to make the Randymere reservoir tight by carrying a puddle wall 40 feet below the existing one. The making of the puddle wall would no doubt form the greater part of the cost of the original reservoir. Perhaps the cost of the puddle wall and banks would be about £7500; and by the time the wall was completed, there would probably be spent upon it £20,000—a sum which, expended in providing a supply of 10,000 gallons of water, he did not, under the special circumstances, consider excessive. He had been called in, in a sense, to make the best of what might be termed a bad bargain. He did not conceive it at all likely there would ever be the necessity to make a puddle wall on the west side of the reservoir.

Re-examined: Seeing that there was at present a reservoir, and that there were also existing mains in connection with Randymere and Hazelhead, he thought the best thing to do was to spend the money as proposed upon the reservoir.

By the CHAIRMAN: The water was from springs, and was perfectly clear.

Mr. *J. Rowland*, the Chairman of the Company, deposed that the present Board of Directors had done all in their power to rectify and remedy the defects and irregularities which, in certain respects, their predecessors had fallen into. Their reason for now applying to Parliament for fresh powers was for the purpose of putting themselves in a proper and sound legal position. Whitby was originally supplied with water chiefly from wells, and by one or two small undertakings. In 1863, a Company was formed, for the purpose of acquiring one or more of those small undertakings, and for establishing new works; and they obtained an Act in 1864. Before applying for that Act, the Company had proposed to the then Local Authority that they should undertake the supply of the town; but they resolved not to do so, but to support the Company. After 1864, the Sleights Moor reservoir was constructed; and water was obtained from that source and conveyed to Whitby. In 1871, the Company, requiring more water, approached Messrs. Foster with the view of coming to some arrangement. In 1882 they obtained permission to construct the reservoir at Randymere, and in 1893 they took over from the owners the water supply of the western part of Whitby. With regard to water-rents, they had not been charged up to the limits of the Company's powers. As to the Hazelhead Springs, since 1871 the Company had tried to take as much water as they could by means of their works. They had allowed Messrs. Foster to take water for the use of agricultural tenants contiguous to the reservoir. The Company had paid Messrs. Foster a dead rental of £100—reserved for water over a certain amount at 1d. per 1000 gallons. The rent had been altered from time to time; and at present it was £200 a year, in lieu of making any charge in respect of royalties. The sum spent up to the present time on the Randymere reservoir was £9284. There had been a leak in the reservoir, which caused damage to agricultural land; and the Company had paid to Messrs. Foster certain sums by way of compensation. The Company were anxious to remedy those defects; but they could not do so without raising additional capital. As to going to the public for capital, they encountered a difficulty, and consequently abandoned the idea. The fact was the Company had only a three years' lease of the water; and with so precarious a tenure, it was felt that the effect of declaring this fact would be to prejudice the raising of the required capital, especially under the operation of the auction clauses.

Cross-examined by Mr. BALFOUR BROWNE: The Company had endeavoured to remedy all the defects which they found. They had, as far as practicable, provided sufficient water for Whitby; but a greater supply was now required. He thought it possible there would be an ample supply if they could stop the leakage at the reservoir. He believed that Messrs. Foster had been willing to meet the Company in every way.

Cross-examined by Mr. FITZGERALD: The books of the Company would show when last they obtained an increase of capital. It was, he thought, in 1882, when they constructed the reservoir. On being questioned as to the dividends paid,

Mr. LITTLER interposed by offering to read the dividends declared since 1864. They were as follows: From 1864 to 1866, the dividend was *nil;* in 1867, it was 2½ per cent.; in 1868, 5 per cent.; 1869 and 1870, 5 per cent.; 1871, 6½ per cent.; 1872, 5 per cent.; 1873, 7½ per cent.; 1874, 8 per cent.; 1875 to 1886, 9½ per cent.; and 1887 to 1893, 8 per cent.

Mr. *H. Sinclair*, the Secretary of the Company, said he was appointed to that position in 1882, on the death of his father, who had long previously held it. During his connection with the Company, they had not charged water-rent up to the full limit of their powers. The number of consumers was not practically increasing, though the consumption was large, owing to the number of visitors to the town. There was an increase in the number of water-closets and baths. The total cost of the Company's undertaking was now £20,920; that of the original works being £13,785. They were not under obligation to afford a constant service under pressure. In witness's opinion, if the leakage at the reservoir could be stopped, there would be an ample supply of water for the town for all purposes.

Mr. *T. Fenwick*, of Leeds, considered the proposals of the Company would, if authorized, effectively remedy all present defects and deficiencies in connection with the works. A constant supply by gravitation would be secured. From the springs above Randymere, there might be obtained 225,000 gallons of water per day. The reservoir had a capacity of 10 million gallons; but there was a leakage amounting to as much as 90,000 gallons per day. He had gauged one leak at the north-east of the reservoir; and from that point there were some 53,500 gallons running to waste daily. At another point, there was found to be a large stream, partly leakage and partly surface water, flowing from the reservoir, amounting, he estimated, to some 156,000 gallons per day. He believed that 90,000 or 100,000 gallons per day would be saved by stopping this leakage. He considered that the terminable lease at present existing with Messrs. Foster was incompatible with the continuous responsibilities of the Company to supply the town with water; and he advised that they should at once purchase the rights of Messrs. Foster.

Mr. BALFOUR BROWNE said he was willing to concede the rights in perpetuity if Messrs. Foster were fairly compensated; and he asked what multiplier witness would use in estimating compensation.

Witness replied that, generally speaking, 25 years might be suggested.

James Beecroft, outdoor foreman to the Company, gave evidence as to the water supply being turned off nightly, as required. He had known instances of fire in the town when the supply of water for the use of the engines had been inadequate.

This concluded the case for the promoters.

Mr. BALFOUR BROWNE then addressed the Committee, asking that, if the promoters of the Bill obtained the additional powers they now sought, they should be constrained to do justice to Messrs. Foster. He thought he should be able to show the Committee that the Company's proposals were not fair, just, or reasonable. They ought to have carried out the works as originally authorized by Parliament in 1864. If, however, they failed to do so, they were really bound to come again to Parliament, and satisfy the Committee that they had some good reason for not carrying out their original obligation, and for asking for fresh powers. It was clear they had no right to take Messrs. Foster's spring. That was altogether *ultra vires*. But they had said to Messrs. Foster, "If you will allow us to take the spring, we will pay you for it." The terms agreed upon were that, for a supply of 65,000 gallons per day, they were to pay his clients £100 a year; and, for any quantity beyond that, they were to pay in addition at the rate of 1d. per 1000 gallons. This arrangement was to be terminable at three years' notice. According to the requirements of the Company and the agreements between them and Messrs. Foster, he contended that, in addition to the £200 a year dead rental, they would, at the rate of 1d. per 1000 gallons, also be liable to pay £240 a year on the extra water supply from that source. It was on this basis that he urged the Committee either to reject the Bill or direct the Company to pay his clients compensation equal to £400 a year rental in perpetuity.

The CHAIRMAN intimated that the Committee considered the scheme proposed by the Company was, on the whole, a reasonable one. It was admitted, he said, that they had in some respects acted *ultra vires*. Messrs. Foster had, however, evinced a desire to meet them in a very conciliatory spirit; and the Committee considered there was reason to hope that, where the differences were really so small, the parties would be able to come to some satisfactory agreement by the following Monday.

Monday, March 18.

Mr. BALFOUR BROWNE this morning announced that, although the exact terms had not yet been absolutely drawn up, there was every probability that an arrangement of the differences between the Company and Messrs. Foster would be soon arrived at. Under these circumstances, therefore, he should not, for the present at least, call any evidence on behalf of his clients.

After a short interval,

Mr. BALFOUR BROWNE said he was glad to inform the Committee that the Company and Messrs. Foster had arrived at an understanding which was to form the basis of a formal agreement. The principal points were that Messrs. Foster should sell to the Company the right to take the water for £7000; and they would allow that sum to remain as a loan at 4 per cent. for a period of twelve years. The costs of the opposition of Messrs. Foster from Nov. 3, 1894, were to be paid, but limited to £500. With regard to the land required for the reservoir, something less than originally suggested—about 45 acres less—had been arranged for. The Company would be conceded a perpetual easement of the land necessary for the reservoir at Hazelhead; and water was to be supplied to the farms on Messrs. Foster's lands at the rate of 250 gallons per day for each homestead, free of expense, though the water itself would be charged for at the rate of 3d. per 1000 gallons. The petitioners would be entitled to minerals anywhere, but not to disturb the surface or make surface works within a limited watershed area at Hazelhead. The Company would be responsible for any future leakage of water from their works. There was clay on the property, which might be taken and used by the Company at 3d. per cubic yard; they making good the surface after taking it. The employees of the Company were to produce, when required by Messrs. Foster, written permits to go over the estate—a proviso intended to prevent the use of the land by others than those *bonâ fide* entitled to do so.

Mr. STEPHENS proceeded to address the Committee on behalf of the District Council. He agreed that the position of the Company was an unfortunate one. From the whole history of the undertaking, it seemed to have been involved in a perfect haze of illegality. As to the landowners, all he had to say was that they seemed to have been willing to trust the Company in a very unusual way, and without asking whether or not those with whom they were treating had powers to carry out what they professed themselves ready to do. As a result, the Company had now been obliged to ask Parliament for future powers against the landowners; while the landowners had only been clearly within their rights in asking to be properly secured. But what he wanted to know was how the town of Whitby, which had a very direct interest in the matter, was to be secured. For a period of no less than 31 years, the Company had been managing the water supply of Whitby, and what was the result? They had not only neglected to carry out certain portions of the work originally confided to them to execute, but they had, wholly *ultra vires*, gone outside the powers conferred by their Act, and had illegally constructed works beyond their authorized district; and this they had done subject to a three years' notice to quit! Then, instead of coming to Parliament for a Bill to legalize their position, the Company, in order to extend their works, made a verbal arrangement with the landowners, amplifying and extending their scheme. Their past conduct, in its remissness and its illegality, demonstrated how little they were to be trusted with new and wider powers; and he protested against an undertaking of such a character being now legalized and saddled upon the town of Whitby for all time. Since 1884 to the present day, the entire working staff of the Company had apparently consisted of a Secretary, a foreman, and a labourer! Was that such an executive as was consistent with a proper and efficient water supply for a town like Whitby? At present the supply was deficient and intermittent, inconvenient to consumers, and detrimental to the public health. It was true the Company had, on the startling report of Mr. Mansergh, awoke at last to the great gravity of their position and the inadequacy of their works; but this state of what he might term "parliamentary penitence" might last only until they obtained their Bill, and then their natural tendency and instincts would be to resume the ordinary currents of their daily lives. The people of Whitby would prefer to see the Bill thrown out, in order that they might have an opportunity for bringing forward a Bill of their own. After criticizing the financial features of the Bill, the learned Counsel said he believed the proper course for Parliament to adopt with regard to such a Bill was to reject it altogether.

The CHAIRMAN intimated that the Committee would not reject it.

Mr. STEPHENS said, in that case, he would ask the Committee to protect the town from the consequences of such a Bill. Reviewing the correspondence which had taken place between the Local Authority and the Company with regard to the transfer of the undertaking to the town, he pointed out that the action of the Local Board had had the cordial assent of the inhabitants—a poll of the ratepayers on the purchase question having resulted in 1200 votes in favour, and 500 against the proposal. If this Bill were to be sanctioned by the Committee, he should ask, in the interests of the town, that a proper purchasing clause should be inserted.

The CHAIRMAN: You ask powers to buy; but where is your undertaking to buy?

Mr. STEPHENS replied that they would bring up a proper clause with that object; and if they failed to purchase within a defined period, the Company should be released from the obligation.

Witnesses were then called on behalf of the petitioners.

Mr. *Henry Walker*, examined by Mr. FITZGERALD, said he was agent of the West Cliff Estate at Whitby, and Vice-Chairman of the District Council. He was of opinion that the supply of water should be in the hands of the town. The matter was brought before the Local Authority last year; and it was then unanimously resolved that the Board should enter into communication with the Company with a view to ascertain the conditions on which they would sell the undertaking. The result was that the Company refused to dispose of it; and so the negotiations came to a standstill. A large majority of the ratepayers were in favour of the transfer.

Mr. *J. H. Harrowing*, the Chairman of the District Council, gave evidence as to the frequent complaints regarding the defective and insufficient nature of the water supply, particularly in the spring and autumn. Sometimes, in case of fire, there had been defective supplies of water—not only shortness in quantity, but deficiency of pressure.

Mr. *T. Keat Scott*, the Borough Surveyor of Whitby, stated that, under their Act of 1864, the Company had large powers of prescribing the fittings to be used, and had allowed constant-supply fittings to be put in various houses. He had repeatedly had to report to the Local Board a deficiency in the supply of water for fire brigade purposes. In cases of fire, there had been shortness of water, and disastrous results had followed.

Cross-examined by Mr. BAGGALLAY: If, as a result of the passing of the present Bill, the Company were to lay down larger mains, and provide a constant water supply under adequate pressure, his chief objections to their system would, no doubt, be removed and obviated.

Mr. *G. F. Deacon* said he had examined the leakage at the Company's reservoir, and found it was a serious one. In order to stop it, the Company proposed to construct a puddle wall along the north-east side of the reservoir. That would have to be carried down not only to where the shale commenced, but the whole distance of the area. It was impossible to say definitely or exactly to what depth it would have to be sunk. He calculated that the cost of the reservoir would be twenty times as great per unit of water impounded as was ordinarily the case. What the Company proposed might improve the reservoir; but the result would certainly not be commensurate with the largeness of the outlay upon it, nor did he think a supply of 2·8 gallons per head would justify an expenditure of the magnitude suggested. As regarded the quality of the water, there was no doubt it was excellent; and to store it in a shallow reservoir would be detrimental to it. The cutting off of the water at night was a serious matter, and prejudicial to the public health. In witness's opinion, it would be to the advantage of the town to have the water supply in its own hands.

Cross-examined: He had made no calculation as to what would be the cost of taking over the water supply. He believed the town would be able to furnish water at a lower price than could possibly be done by the Company. He might use the present reservoir for what it was worth; but he certainly would not spend £10,000, £14,000, or £15,000 upon it.

Tuesday, March 19.

Mr. *Boyd Dawkins*, F.R.S., was called to speak as to the geological formation of the ground whereon the Randymere reservoir was situated. His opinion was that it was of so uncertain and irregular a character as to render it very doubtful indeed whether the proposed works—the construction of a puddle wall, &c.—would have the effect of remedying the leakage. The south-west side of the reservoir would still be open to percolation; and not improbably there was considerable leakage at the bottom. It was quite likely that the reservoir would not be made water-tight except at great expense—so great, in fact, as to render it a very unsatisfactory way of supplying Whitby with water.

In cross-examination by Mr. BAGGALLAY, witness thought it probable that there was a leakage at the bottom of the reservoir. Of course, if there was not, the deductions which he drew from that presumption would necessarily fall to the ground. He had not seen the bottom of the reservoir; and what he had stated as his opinion was the result of inference.

Mr. BAGGALLAY, replying on the whole case, said he was not quite sure whether the idea of the District Council was to throw out the Bill, or whether they desired to get the Committee to impose upon the promoters as a condition a purchase clause.

The CHAIRMAN: It may assist you if I at once say that the Committee consider the preamble of the Bill to be proved.

Mr. BAGGALLAY said that in that case he could deal at once with the question of capital. There had been no evidence given nor suggestion made that, if the proposed works were authorized, the amount of capital would be out of proportion with the works. It had been admitted that, if the works and other conditions set forth in the Bill were to be carried out, the £27,500 asked for would be necessary. This only left a margin of £7500 for the ordinary work of relaying the mains in the town, and making further and better provision for water distribution. Out of the £7500, there was also a certain amount of overdraft, and some expenditure incurred in coming to Parliament for the present Bill, which would have to be met. Therefore the Committee could have no hesitation in saying that the sum asked for by the Company was not disproportionate to the requirements of the case. After reminding the Committee that a continuous supply of water would be secured to Whitby under the Bill, he turned to the question of purchase. He submitted that there was a great difficulty in the way of purchase in the present case, and which could not be overcome as the Bill now stood. The concession of a purchasing clause as asked by the Local Authority would involve the giving of parliamentary powers to that Authority which would be outside their district and jurisdiction as a Local Authority, because by the Bill they could not be put in the position of the Water Company, and their district was not coterminous with the area comprised within that covered by the Bill. The time to consider such a proposal would be when the Local Authority should bring up their Bill. Vindicating the Directors of the Company from the attacks made upon them, he declared they had run risks and incurred blame because they had shown excessive anxiety to improve the supply, as much for the benefit of the water consumers as for the interest of the Company. Was that, he asked, the sort of offence which the Committee would punish by depriving the Company of the value of their undertaking, because the effect of refusing now to legalize their position would be to take from their undertaking a considerable portion of its value.

The CHAIRMAN: Suppose you have your new Act, where would the injustice come in if you were to sell to the Local Authority?

Mr. BAGGALLAY replied that, if the price of purchase were to be fixed on the footing that the Company's works were legal, he admitted that legalization of the Company's position and vindication of the value of their property, would remove a great deal of his complaint on that score. But he was thrown back on the difficulty that this course could not be taken under the present Bill. He urged, therefore, that unless the Committee found overpowering grievance and complaint against the Company, they should not insert a purchase clause, but leave it

for the Local Board (after proper notices given to the different districts and authorities interested) to promote their own Bill, and not imperil the Bill of the Company.

The CHAIRMAN, after some discussion on the point, said the Committee desired to hear Mr. Pembroke Stephens on the mode in which he proposed to introduce a purchase clause which would obviate the difficulty as to the supply of outside districts arising from the undertaking being in the hands of the Local Authority; the Committee conceding to Mr. Baggallay the right of reply.

Wednesday, March 20.

Mr. LITTLER desired to point out, before Mr. Pembroke Stephens was heard by the Committee, that, if a purchase clause were inserted in the Bill, in the absence of proper parliamentary notice—of which there was absolutely none—such a course would be fatal to the Bill.

The CHAIRMAN: We have considered that point, and have been advised thereon; and we shall now hear Mr. Stephens.

Mr. PEMBROKE STEPHENS said his learned friends on the other side confused two things. It should be borne in mind that the Local Authority had never given any notices in this matter, nor had they had any hand in the preparation of the Bill, which was solely the production of the Water Company. The Committee must start from the point of view that it was the Company's doing, and that they came to Parliament in order to be put in an improved and legalized position. Now, consistently with these considerations, what were the powers of the Committee in this case? He understood the promoters asserted that the idea of a local authority purchasing a water-works undertaking, part of which was outside their own limits, was a thing unheard of. He produced as a short answer to that a "Model Bill;" and one of the provisions, laid down as a sort of guide in cases like the present, was for the sale of a water company's plant lying outside the district of a purchasing local authority. This being so, away went at once the promoters' objection to the purchase of their undertaking by the Local Authority. He had never asserted that the Bill framed by the Company could give the Local Authority the necessary power for the completion of the purchase and transfer. What he did say, and what he would maintain, however, was that into a Bill of this session they could put a clause which would facilitate the purchase and govern the ultimate settlement of a scheme under any completed Act which the Local Authority might hereafter obtain. It would be quite possible in this Bill to fix a time within which the District Council should give notice to purchase and introduce a Bill of their own; to bind the Company not to oppose such a Bill when introduced; to define the mode in which the purchase price was to be ascertained; and to say whether, and to what extent, the Company should have the right to turn to account in money value the condoning and whitewashing of their past management as extended to them under this Bill. He did not object to the arrangement arrived at between the Company and Messrs. Foster, whereby the latter were to receive £7000 as the price of the water supply they had to sell; but they ought not to have to pay for the byegone irregularities and illegalities of the Company. It would also be quite within the powers of the Committee to direct the insertion of a clause restraining the Company from spending more than was absolutely necessary in the way of capital, without the consent of those who were eventually to purchase the undertaking. He urged that the Committee should not, by passing this Bill as it stood, place the Company in a position to snap their fingers at the Local Authority and the ratepayers.

Mr. BAGGALLAY, in reply, traversed in detail and at some length, the arguments and contentions of Mr. Stephens. He asked that, whatever might have been the demerits of the Company in the past, as the petitioners would for the purpose of purchase have to come for a Bill of their own, the Committee should allow the whole matter of purchase to stand over to be discussed and settled then, instead of dealing with it partially now and partially hereafter. As to the clause of the "Model Bill" quoted by Mr. Stephens, he could not imagine anything more absurd than the putting of it forward as a precedent for compulsory purchase. The clause was really intended to apply to a case where a local authority came to Parliament for the first time for powers to purchase water pipes or plant outside its existing district, but was not applicable in an instance like the present. To lay down the principle that a local authority might obtain power to purchase a company's undertaking without having given due and proper parliamentary notices, would be a dangerous thing.

The Committee having considered the matter,

The CHAIRMAN said: The decision of the Committee is that the preamble of the Bill has already been proved. The agreement with Messrs. Foster is to be incorporated in the Bill. The amount of the Company's old capital to be sanctioned is £10,000; the new capital is £12,000; and the limit of borrowing powers is fixed at £5500. The interest on the old and new capital is fixed at 7 per cent. per annum. The Committee will not insert a clause for purchase, but will insert a clause that—"In the event of the undertaking being acquired by the Whitby District Council, the amount of capital authorized to be raised under this Act, except so much thereof as shall have been expended on works authorized by this Act, shall not be deemed to have increased the capital value of the undertaking, or be the subject of compensation or purchase."

The settlement of the contested clauses was then proceeded with. It was arranged, by consent, that the period within which the works proposed under the Bill were to be completed should be four years instead of six, as originally proposed. It was also agreed that the water supply should be a constant one under a pressure not less than would be afforded by gravitation from the Sneaton Castle service reservoir.

Leeds Corporation Water-Works.—The Leeds Corporation Water Committee have authorized the City Engineer (Mr. T. Hewson), to arrange for the erection of two 200-horse power engines and the requisite boilers at the Headingley pumping-station, with a view of ensuring a better and more continuous supply of water to such high altitudes of the city as Bramley and Moortown.

LEGAL INTELLIGENCE.

HIGH COURT OF JUSTICE—QUEEN'S BENCH DIVISION.

Tuesday, April 9.

(*Before Justices* CAVE *and* LAWRANCE.)

Southwark and Vauxhall Water Company v. Evershed—A Question under the Water Supply Regulations.

This was an appeal from a decision of Mr. Denman at the South-Western Police Court; and it raised a question as to the interpretation to be put upon certain words in one of the regulations (No. 21) made by the Board of Trade in pursuance of the powers contained in the Metropolis Water Act, 1871. The proceedings before the Magistrate were reported in the JOURNAL for Dec. 25 (p. 1216).

Mr. M'CALL, Q.C., and Mr. HORTON appeared for the appellants and Mr. FOOTE represented the respondent.

Mr. M'CALL said that, under the Act of 1871, water companies were for the first time compelled to give a constant supply; and as the fittings which were previously efficient were unsuitable for a constant supply, certain regulations were made. It appeared that the respondent was summoned before the Magistrate for refusing to comply with one of these regulations in respect of certain premises situated in Orchard Street, Wandsworth. This regulation (No. 21) provided that every water-closet service-box should have "an efficient waste-preventing apparatus, so constructed as not to be capable of discharging more than 2 gallons of water at each flush." Since the Act came into operation, the respondent had erected, on the premises in question, a water-closet cistern or service-box; and in March last year he was served with notice to furnish the premises with the prescribed fittings. On the 30th of October, the house was inspected; and it was found that the service-box, after the contents had been emptied, was capable of discharging water so long as the chain was kept at a certain tension. The Company produced a service-box with a waste-preventer attached, and tendered evidence to show that it could be obtained in the locality at the same cost as the one complained of, and that it fulfilled the condition of not discharging more than 2 gallons of water at one flush. This evidence the Magistrate rejected, and dismissed the summons upon the ground that the waste-preventer in use was not capable of discharging more than the specified quantity unless it was deliberately caused to do so. The governing words of the regulation were "so constructed as not to be capable of discharging more than 2 gallons at each flush;" and the Company contended that if the box now in use was considered efficient, the whole purpose of the regulation would be absolutely destroyed.

Justice CAVE asked whether the Company supposed that a person would stand in the water-closet all day holding the chain so that the water might escape.

Mr. M'CALL said certainly not. But he could prove that it was usual for persons to fix a nail upon which the ring at the end of the chain was put; and in this way the water was allowed to escape. A waste-preventer that merely allowed water to run through to the closet was obviously not the apparatus intended by the regulation.

Justice CAVE: How came this preventer to be put up?

Mr. M'CALL said the person who owned the premises evidently went to a man who did not know what the requirements were. The learned Counsel contended that it would be reducing the regulation to a nullity to say that it could only be enforced when it was proved that the chain had been wilfully tied down. A breach of the regulation being proved, he asked the Court to remit the case to the Magistrate to convict.

Mr. FOOTE argued that the Magistrate was right in the conclusion he had come to—that the words "capable of discharging more than 2 gallons at one flush" meant capable in its ordinary use, not misuse. If the appliance was used as an ordinary consumer used it, it was not capable of discharging more than 2 gallons at one flush. The Company seemed to ignore altogether the word "flush," which meant one ordinary pull of the chain, such as was intended to be given. When looked at in this way, the cistern complied with the regulation. The proper course for the Company, if the appliance was inefficient, was to give notice to the consumer to substitute a new one; and if that notice were not complied with, to summon the person for disobeying it. It would then be for the Magistrate to determine what was a proper fitting; and from this decision no appeal would lie. In the present case, the summons was not for disobeying, but for non-compliance with, the regulation. It could not be said that the respondent had wilfully refused to comply with the regulation. All he had done was not to comply with the notice; and consequently a penalty could not be imposed. The question of whether or not the appliance was capable of discharging more than 2 gallons of water (which was entirely one of fact and not of law) had been decided in favour of the respondent; and this decision he asked the Court to uphold.

Justice CAVE said the Court would take time to consider their judgment.

Unlawfully Disconnecting a Gas-Meter.

At the Lambeth Police Court last Friday, Mr. L. D. Hyland, of Palace Road, Tulse Hill, was summoned by the South Metropolitan was Company for having unlawfully disconnected a certain meter without previously giving twenty-four hours' notice in writing to the Company of his intention so to do. Mr. F. W. Hartley, an officer of the Company, stated that in consequence of what he heard from a fitter, he went on the 1st of April to the defendant's premises, and found that the meter had been disconnected and taken away. No notice had been given to the Company. The next day a notice was received from the defendant. A Solicitor, who appeared for the defence, explained that the meter was disconnected and removed for a few hours to be tested. It was found to be inaccurate; and the defendant then sent to the Company asking them to lend him another meter while his own was repaired. They not only refused to do this, but had left the defendant (who had been a large consumer for years) without gas ever since. Mr. Hopkins ordered defendant to pay a nominal penalty of 5s.

MISCELLANEOUS NEWS.

METROPOLIS GAS SUPPLY.

The Quality of the Gas during the Past Quarter.

The following is an abstract of the report of the Chief Gas Examiner for the Metropolis (Dr. A. W. Williamson, F.R.S.) as to the quality of the gas supplied by The Gaslight and Coke, Commercial, and South Metropolitan Companies, during the quarter ending the 31st ult.:—

I. *With respect to Illuminating Power.*—The average illuminating power, in standard sperm candles, at each of the testing-stations, was as follows:—

The Gaslight and Coke Company—	
Fenchurch Street, E.C.	16·4
Kinghorn Street, E.C.	16·7
Dorset Buildings, E.C.	16·7
Ladbroke Grove, W.	16·4
Devon's Road, E.	16·2
Carlyle Square, Chelsea, S.W.	16·1
Camden Street, N.W.	16·3
George Street, N.W.	16·2
Graham Road, E.	16·6
Kingsland Road, E.	16·8
Spring Gardens, S.W.	16·3
Grove Gardens, St. John's Wood, N.W.	16·3
Hornsey Road, N.	16·3
Lambeth Road, S.E.	16·1
Millbank Street, S.W.	16·5
Commercial Gas Company—	
Parnell Road, E.	16·0
Wellclose Square, E.	16·3
South Metropolitan Gas Company—	
Hill Street, S.E.	16·6
Bedford Road, S.W.	16·2
Stoney Lane, S.E.	16·6
Lewisham Road, S.E.	16·3
Blackfriars Road, S.E.	16·4
Burrage Road, S.E.	16·3

It will be seen from these results that the average illuminating power of the gas has been higher than the parliamentary standard of 16 candles at all the testing-stations.

II. *As regards Purity.*—Sulphuretted hydrogen has not been present in the gas at any of the testing-stations. A slight excess of sulphur (23·6 grains) was reported to have been present in the gas tested at Wellclose Square on the 28th of January, and at Bedford Road (22·3 grains) on the 3rd of January. With these exceptions, the maximum amount present in the gas at all the testing-stations was within the limit allowed. Ammonia has been generally present in the gas more or less frequently at all the testing-stations, but only in slight quantities. With the exception of two occasions at the Bedford Road station, the amount allowed was not exceeded at any of the testing-places.

April 10, 1895. (Signed) ALEX. W. WILLIAMSON.

THE RECENT EXPLOSIONS IN ELECTRIC LIGHT BOXES.

Report on the Alkaline Deposit on the St. Pancras Mains.

As mentioned in our "Electric Lighting Memoranda" last week, the Committee, composed of members of the Royal Society and the Institution of Electrical Engineers, appointed to confer with the Electrical Adviser to the Board of Trade (Major Cardew, R.E.) with regard to the circumstances connected with the formation in large quantity of an alkaline deposit on the mains of the St. Pancras electric light supply, and the presence in this deposit in some cases of the alkaline metals in an unoxidized condition, have made their report to the Board. It is signed by Major Cardew, Lord Rayleigh, Professor T. E. Thorpe, Professor W. Crookes, Mr. R. E. Crompton, Mr. Alex. Siemens, and Professor A. B. W. Kennedy. The Committee held three meetings; and a *précis* of the proceedings thereat, prepared by Professor Thorpe, is attached to the report. After taking evidence as to the present condition of the mains of the St. Pancras electric lighting system, and receiving from Professor Thorpe reports of analyses, made under his direction, of the chemical composition of the incrustation found on the insulators of these mains, and of the salts contained in the bearers of the insulators, the mortar and concrete of the conduits, and the adjacent soil, the following conclusion was arrived at: "The Committee are of opinion that the explosions which have occurred were caused by the firing of an explosive mixture of coal gas and air by sparks caused by means of the above-mentioned incrustation. It has been proved that sparks may be caused either by the incrustation itself acting as an imperfect electrical conductor, or by moisture coming into contact with metallic sodium or potassium, both of which metals have been found to exist within the incrustation. These metals have been produced by the electrolytic decomposition of alkaline salts chiefly derived from the soil, and conveyed by moisture along the fibres of the wooden bearers towards the negative conductor. To avoid a repetition of these accidents, the bearers of the insulators at present in use should be replaced by other devices through which moisture is prevented from travelling; and it is recommended that the pattern of insulator in use should be changed, and a pattern adopted in which a longer insulating surface is interposed between the conductors and the bearer. The Committee are also of opinion that it is desirable that means should be provided by which the conduits can be inspected throughout their length, so far as is necessary to detect incrustations on the insulators. The Committee have not thought it within their province to investigate the causes of the presence of coal gas within the electric lighting conduits; but it is obvious that this is the primary source of danger."

The following is the *précis* of the proceedings of the Committee already referred to:—

At the first meeting (on March 4), Mr. Baron, Chief Engineer of the St. Pancras electric lighting works, gave detailed evidence as to the deposit or incrustation on the insulators on the St. Pancras mains, from which it appears that it was first noticed about 18 months ago, and found to be alkaline; that from 60 to 70 per cent. of the whole number of insulators which can be examined—*i.e.*, those in or near the street-boxes—are affected by it, and that in some cases, when scraped off, it forms again within 24 hours; that the insulators which are supported on wood bearers at the various street-boxes are those generally affected; and that only in two or three cases has any incrustation been found in the intermediate insulators within the culverts, which are supported on iron brackets. These wood bearers have become thoroughly saturated with saline moisture. They are supported at each end by being let into the brick sides of the culvert; and in some cases the end fibres of the wood may be in contact with the soil. Mr. Baron has seen the deposit flame with a yellow sodium flame in several instances when water was dropped on to it, or when it was dropped upon wet ground. He has also seen sparking from the negative main over the insulator to the wood bearer, and has produced the same by experiment with a solution of the material deposited. The insulator in this test was moistened on the surface with clean water, and the wood bearer was standing in the solution. The sparks occurred in about five minutes. The glaze on the insulator has been attacked in some cases. He does not think that the process of salting the streets in order to melt snow has any connection with the formation of the deposit. Mr. Miller, of the Kensington and Knightsbridge Electric Lighting Company, also gave evidence as to leakage from the negative main always attracting moisture; and he stated that a negatively-charged cable belonging to his Company, laid in the subway at Kensington Court, had a small fault of insulation, which apparently gave rise to a moist efflorescence on the adjacent brickwork, which, if brushed with the hand, emitted a sort of phosphorescent light in the dark. His Company has experienced no trouble from incrustation on the insulators; but very high quality insulators of hardened glass or porcelain, and of the "double shed" pattern, were used. In their system, every insulator used can be easily examined.

On the 6th of March, Lord Rayleigh, Professor Crookes, and Professor Thorpe visited the St. Pancras mains. At a street-box near Chester Gate, Regent's Park, a piece of incrustation in a moderately hard and friable condition, about the size of a hazel nut, was taken from the negative main. This was placed on the cover of the street-box, and some water put on it, when it broke into flame. There appeared to be several nodules of metal, one about the size of a pea. This metal was solid. Some flashes of sodium flame were also seen along the wood bearer, as if the metal had been deposited there. The wood was saturated with moisture, especially under the negative main. This wood bearer was subsequently sent to Professor Thorpe for examination. At the places corresponding to the position of the negative main, the wood was much blackened and carbonized, and was very wet. On cutting it into six pieces, it was found that the wood was saturated with alkaline salts, which were strongly caustic near the negative main, and chiefly carbonates of potash and soda at the ends. The soil, mortar, and concrete at this point have also been tested by Professor Thorpe; and his analysis appears below.

At the second meeting (on March 8), Mr. Crompton produced three specimens of deposits taken from the insulators of the Southampton electric light mains. These have also been analyzed by Professor Thorpe, who produced an analysis of three samples of the deposit obtained from the St. Pancras mains. Considerable discussion took place as to the exact process by which the incrustation and the free metal were produced; and it was finally decided to have another meeting before reporting.

At the third meeting (on March 22), further specimens from the St. Pancras mains were examined, and Professor Thorpe's analyses were considered. A glass insulator from the Southampton mains, showing a considerable amount of deposit, was also submitted. The report was then discussed and adopted.

The following are Professor Thorpe's analyses, referred to above:—

Deposits from St. Pancras Electrical Mains.—The samples had the following percentage composition: Caustic soda, 7·69; caustic potash, 4·88; sodium carbonate, 34·40; potassium carbonate, 52·77—total, 99·74, *plus* traces of silica, alumina, and lime.

Samples from Southampton.—All were practically pure sodium carbonate, with a very small admixture of potassium carbonate. The sample taken from the earthenware insulator was amorphous, and contained appreciable traces of calcium carbonate; the other two (from glass insulator and distributor) were crystalline, and free from all except adherent impurities. None of the samples contained free alkali.

Soil, Mortar, and Concrete from St. Pancras.—The aqueous extract obtained from each of these by slow percolation had an alkaline reaction (alkalinity = from 0·12 to 0·23 gramme NaHO per 250 cubic centimetres of extract), and contained in each case compounds of sodium and potassium; the latter being present in moderately large proportion.

Major Cardew's Report on the Southwark Bridge Explosions.

In the "Electric Lighting Memoranda" in the JOURNAL for the 2nd inst., reference was made to the report presented by Major Cardew to the Board of Trade on the subject of the explosions which occurred on Southwark Bridge on the 1st of February last. He held an inquiry into the circumstances on the following Monday (see *ante*, p. 327); and sent in his report a few days later. It was issued as a parliamentary paper last Wednesday; and, though its conclusions have already been made known, it may be of interest to reproduce the principal portions of the document. It was accompanied by a transcript of the shorthand notes of the evidence given at the inquiry; and also by a plan and section showing the various pipes and manholes, &c., at the spot where the explosions appeared to have originated, and a tracing giving a plan of the entire bridge, and showing the street-boxes in connection

with the mains of the Electric Lighting Company in which explosions took place—also indicating the pipes, manholes, &c., at the south end of the bridge. After setting forth these facts, Major Cardew proceeded as follows:—

In order to explain the occurrence of these explosions, it is necessary to refer in considerable detail to these underground arrangements. They consist, first, of a brickwork culvert covered by an iron grating, and used in connection with the surface drainage, which crosses under the roadway, terminating on the east side in a dead-end under the pavement; but on the west side, an iron pipe connected to the culvert passes through the side of the bridge, and is continued down to the river. At each side of the roadway, catchpits have been recently constructed, discharging, by means of a short length of pipe (not trapped in any way), into the culvert. These catchpits have the usual iron gulley gratings at the level of the road. Under the footway on the west side, there is a manhole closed by a stone slab, and giving access to the culvert. A 3-inch cast-iron gas-pipe crosses about 6 inches above the culvert in the roadway on the west side. This pipe bends at right angles, and terminates in a dead-end; but a small service-pipe is taken from it to a gas-meter in a pit under the footway. From this meter a supply is given to the lamps on the west side of the bridge, by means of a pipe led along the outside of the parapet. The pipes belonging to the Electric Lighting Company pass along under the footway just inside the kerb. They cross over the culvert and over the 3-inch gas-pipe, but under the small gas-service pipe. None of the Electric Lighting Company's pipes, however, at this spot contain mains; these being led away from the two street-boxes on the west side of the bridge through the parapet, and down the pier of the bridge in a large iron casing. On the east side of the bridge, there are a large number of electric mains in iron pipes and in bitumen casing passing under the footway and over the culvert.

From the evidence given at the inquiry, there appears to be no doubt that the first explosion occurred in the culvert under the pavement and roadway on the west side of the south end of the bridge. Several witnesses were positive that this explosion occurred first, by an appreciable interval of time; and one of them (Mr. W. C. Palmer) could hardly have made a mistake on this point, as he was in a pony cart close to the explosion, and the pony and cart had moved across the road before the second explosion took place. This first explosion was by far the most intense of all which occurred; many paving-stones being completely shattered. One woman was reported to be rather seriously injured by the *débris*. It was immediately followed by three explosions in the street-boxes of the Electric Lighting Company on the opposite (east) side of the bridge. One woman and two men were injured by these explosions; one man being blown up about 6 or 7 feet according to the evidence of a policeman. This man, however, was able to give evidence at the inquiry. The covers and frames of the boxes were broken, and the pavement displaced at each box. A slight explosion appears also to have occurred in the street-box [near the culvert] on this side; but this was not sufficiently intense to displace the cover.

The officials of the Electric Lighting Company were on the spot shortly after the occurrence, and those of the Gas Company as soon as they could be summoned. They found both the gas-meter boxes full of gas, which was also issuing freely from the gulley grating over the catchpit on the west side. On opening the ground over the culvert, a large crack was found in the 3-inch gas-main, out of which the gas was coming in volumes. This crack extended about half way round the pipe, on the upper side. There was also a longitudinal crack in the pipe at the same place; but this appears to have been an old injury, and to have so far rusted up that there was little, if any, leakage through it. The roadway over this gas-pipe was frozen very hard, and was practically impermeable to gas; but between the pipe and the grating of the culvert immediately below it, the soil was very loose, and some vacant space seems to have existed. Thus the gas found easy access to the culvert.

How it was fired cannot, I fear, be exactly ascertained; but I think I can confidently assert that it was not by means of the electric lighting mains. As before mentioned, there were no electric mains in the immediate vicinity of the first explosion; and the empty pipes prepared to take the mains do not appear to have been in any way injured. These pipes, it is true, communicate, at a distance of about 16 feet, with a box which contains electric mains. I examined this box, but found no signs of any firing of gas having taken place within it. The voltmeter records of the Electric Lighting Company show no trace of disturbance on the circuits at the time of these explosions; and as the mains in use were all concentric cables, the outer conductors of which were thoroughly connected to earth at the generating-station, I do not think they are likely to have produced a spark. The fact that there was no explosion in the street-boxes on the west side of the bridge is a further proof that the escaped gas had not penetrated into them, and, in consequence, that it could not have been fired by the electric mains. It was stated in evidence that a match which had recently been alight was found in the catchpit communicating with the culvert; and this may possibly have fired the gas.

I believe that, in the case of firing by ordinary flame, it sometimes happens that the gas burns quietly for a considerable time, should it be in too great a quantity to form an explosive mixture, and that, when the flame reaches a layer of explosive composition, a violent explosion may result. It is, I think, quite possible that this may have occurred in this instance, and that the person who threw the lighted match into the catchpit may be quite unaware that he thereby caused the explosion. The only other cause I can suggest is a spark struck by a horse's foot or a wheel close to the gully grating, out of which the gas was issuing freely.

The explosion appears to have traversed the culvert, and followed the course of the gas, which had percolated into the electric light box near it on the east side of the bridge, whence it found its way by means of the pipes to the others. The access to the first box appears to have been afforded by imperfect sealing round the pipes entering the box, which passed just over the culvert. This was tested by firing some smoke rockets inside this box, when the smoke appeared in considerable volume at the culvert after about one minute, and seemed to be travelling along the outside of the pipes. Apparently on the west side the gas was unable to force its way into the electric light box; but in this case the box had only been constructed, and the pipes in connection with it laid, about a fortnight before the explosions occurred, and the pipes crossed at a greater height above the culvert.

Having obtained access to the first box, the connecting-pipes gave an easy passage to the three others. As far as the third box, the slope of the roadway favoured the passage of the gas; beyond that it was forced down the slope by the pressure from behind, and no doubt travelled more slowly. The explosion in the fourth box appears not to have been quite so violent as in the third. Had more time been allowed for the penetration of gas along the system of pipes, there is every reason to believe that more explosions would have occurred.

The existence of numerous empty pipes in the system of mains laid by the City Electric Lighting Company, to which I called attention in my report on the Cannon Street explosion in November last [*ante*, p. 324], greatly facilitates the passage of gas, should it find access in consider able quantity at any point. This accident appears to me to suggest far more serious cause for anxiety than that which recently occurred in Cannon Street. It is true that in this case there was no electrical charging of the ground, or any defect in the electric lighting mains, and that the explosions were not due to any electrical action. But the Cannon Street accident was caused by a gross blunder on the part of the Electric Lighting Company; and the Company have since taken steps to make a repetition impossible.

The most striking features about the Southwark Bridge accident are: (1) The distance to which it appears that a series of explosions may travel along the electric mains which form a gigantic network under the whole of the streets of the City; and (2) the proof it affords of the insufficiency of any ordinary system of ventilation of these pipes and street-boxes, if gas can find an easy access to them, and the necessity of exercising great care to make and keep the boxes impervious to gas. The culvert which exploded in this case was provided, by means of the catchpits and gulley gratings, with large openings for the escape of gas; and yet these did not prevent the explosion, and indeed probably enabled the accumulated gas to be fired. This culvert, however, so far from being impervious to gas, permitted it easy access through the openings of the grating forming the lid of the culvert.

After very careful consideration of the recent accident, I adhere to the recommendations as to prevention of accumulation of gas detailed in my report on the Cannon Street accident. Had these been carried out, there would have been no explosion in the electric light conduits. I am, however, inclined to give more emphasis to the suggestion that the air capacity of the street-boxes should be reduced by filling with incombustible material, and to add that, unless and until an efficient system of ventilation by forced draught is provided, all the pipes and conduits should be thoroughly plugged at each box (as recommended by Major-General Webber, C.B.).

With this addition, I can only repeat the requirement No. 7 of my former report: "Accumulation of gas should be prevented by thorough ventilation, by making the sides and bottoms of street-boxes impervious to gas, and by filling up the boxes as far as practicable with incombustible material." To this I would now add "by thoroughly plugging pipes and conduits at each street box, to prevent passage of gas along the system;" and I put the filling up the boxes first, as the most simple and certain method of preventing danger of explosion. In cases where the boxes are completely filled up, it will obviously not be necessary to adopt the other precautions.

So far the Electric Lighting Company have done very little towards carrying out this requirement. It appears that only 18 boxes have been provided with ventilating-pipes; and these are not, in the cases I have examined, carried up at least 8 feet from the ground, as recommended by me, but terminate a few inches from the pavement. The Company have, however, protected the orifices with a cap and a screen of fine wire gauze, which may sufficiently guard against the danger of the gas issuing from these pipes becoming ignited by a match carelessly thrown near them.

It must be admitted that in this case the main cause of the explosions was the defect in the gas-pipe; and it again directs attention to the very serious danger to the public arising from the condition of the gas-pipes in many districts, and the way in which they are laid and supported—a danger which is continually increasing, owing to the spread of the use of wood paving and other impervious surfaces, and and which is temporarily intensified by every severe frost. No remissness on the part of the Gas Companies can, however, relieve the Electric Lighting Company of the duty of thoroughly complying with regulations Nos. 14 and 15, by sufficiently protecting their conduits and street-boxes against an accumulation of gas. How this may be done, I have already specified in this report and in my report on the Cannon Street accident; and I recommend that the Board of Trade should require the City of London Electric Lighting Company to at once take the necessary measures to fully comply with the regulations imposed by the Board of Trade for the protection of the public safety.

Bolton Corporation Gas-Works Finances.—The report of Mr. W. Walch, the Office Superintendent of the Bolton Corporation Gas Department, for the past financial year is of a most satisfactory character. The total cash receipts for the twelve months aggregate £44,686—an increase of £2945 upon those of the preceding twelve months. The extra sale of gas has added £4000 to the revenue; and a further sum of £13,000 has been realized by the enhanced value of tar. This amount, however, has been to a considerable extent neutralized by the diminished value of coke, and the partial abolition of meter-rents.

Accident to a Large Water-Main at Cardiff.—In the small hours of Sunday morning last week, a 30-inch water-main running down Senghenydd Road, Cathays, Cardiff, burst, causing great alarm in the immediate neighbourhood. The water ran furiously down the road, until its progress was arrested under a railway bridge. Here it accumulated to a depth of nearly 5 feet. Along the route, cellars were submerged, and much damage was done to stock and furniture. The cause of the accident is unknown; Mr. Priestley, the Deputy Water-Works Engineer, being unable to discover a flaw in the main. It is estimated that quite 3 million gallons of water escaped.

SALFORD CORPORATION GAS-WORKS.

Local Government Board Inquiry—Important Extensions.

Last Friday, Major-General C. PHIPPS CAREY held an inquiry at Salford respecting an application by the Town Council for permission to borrow £100,000 for the purposes of the gas-works.

The TOWN CLERK (Mr. Samuel Brown) appeared in support of the application; and Mr. J. WIDDOWSON opposed on behalf of the Swinton and Pendlebury District Council, who desired to secure greater powers than they at present possess.

The TOWN CLERK, in opening the proceedings, explained that in 1891 the Corporation obtained a Provisional Order, authorizing them to borrow £134,000 for gas-works purposes. This amount included £14,000, which was a debit-balance at the bank, and the remaining sum of £120,000 was for contemplated works, most of which had already been carried out. This sum had from time to time been borrowed with the sanction of the Local Government Board; and the total amount obtained had been £127,352, which left a balance of £6648. About the time the Order was granted, the Corporation were actively engaged in an extensive alteration of a retort-house, the expenditure on which the Council could not then estimate. The Local Government Board suggested that the money should be borrowed when the work was nearer completion. The work was carried out at a cost of £13,268 in excess of the loan. An inquiry was held; and the Local Government Board, instead of granting the money to cover the extra cost, stated that, as the Gas Committee would most likely have to make further applications during the next few years, it would be better if they completed an estimate of expenditure to cover the next five years, and also included the £13,268. The estimated expenditure for the next five years (with the £13,268) was £100,000.

Mr. *S. Y. Shoubridge*, the Corporation Gas Engineer, stated that the estimate was based on the expenditure during the last five years, which reached about £120,000. The first item of expenditure was the gas-holders. The present storage capacity was 7,358,000 cubic feet; and it was proposed to add three lifts to the holders at the Bloom Street works—thereby increasing the storage from 888,000 to 1,774,000 cubic feet. The cost of this would amount to about £7000, which was based on the cost of the last holders altered in a similar way. When the enlargements were completed, the total storage capacity would be increased to 8,224,000 cubic feet, which would then be slightly in excess of one day's consumption of gas, which was the usual storage capacity of most modern gas-works. The other items of proposed expenditure included £1800 for an additional condenser; £1000 for scrubbers; £1500 for hydraulic machinery for the purifiers; £1000 for sulphate plant; £250 for coke-hoppers; and £2100 for the provision of governors, valves, connections, and the requisite land, for the regulation of the pressure of gas supplied to the Higher Broughton district of the borough. The expenditure on street mains was put down at £25,000, which was based on the average for the last five years; and £20,000 for meters. The consumption of gas was 9·4 per cent. over the previous year. For gas-stoves, an expenditure of £7500 was required, which also was estimated on that of the past five years.

The TOWN CLERK said the total excess expenditure in the Provisional Order of 1891 for street mains, meters, and stoves was £11,554. For street mains £20,728 was spent; the original estimate being £17,450, or an excess of £3278. For meters the estimated expenditure was £12,964, and the amount spent was £18,020, or an excess of £4944. For gas-stoves the original estimate was £3000, and the sum spent was £6033, or an excess of £3033. This £11,255 was included in the present application for £100,000. In regard to that item, he had had some correspondence with the Local Government Board, who pointed out that sums of money were included under the heads referred to in the 1891 Order. That was so; but what the Corporation said was that the sums under those heads had been exceeded. Of course, if the £11,255 could not be included in the present application, it would be necessary to obtain another Provisional Order to cover it. The Gas Committee had thought fit to add about £4000 for contingencies; bringing up the total to the round sum of £100,000.

Mr. J. HEMPSALL, one of the Elective Auditors for Salford, asked whether it was a fact that the receipts for gas sold to consumers decreased by £2000 from 1893 to 1894.

Mr. *Shoubridge* replied that in 1892-3 the quantity of gas sent out from the whole of the works reached 1,110,299,000 cubic feet; in 1893-4 (the year of the coal strike), the output was 1,090,261,000; and for the year ending March, 1895, it was 1,192,792,000 cubic feet.

The TOWN CLERK remarked that the consumption of gas decreased all over England in the year 1893.

In reply to Mr. WIDDOWSON, witness said the £25,000 for mains was based on probable expenses on renewals, enlargements and extensions, and also to supply new consumers. Little or no improvements had been made during the past year on the mains.

Mr. WIDDOWSON said the chief objection he had to make was that in the district he represented a differential rate was imposed; and no more difficulty was experienced by the Corporation in supplying them with gas than in the district of Irlams-'oth-Height, which was contiguous to the Swinton and Pendlebury district. Another objection taken was the very large amount made in profits by the Gas Committee owing principally to these differential rates. The Swinton District Council must certainly have long ago paid for any initial expense for which a differential rate might be supposed to be levied. The quality of the gas supplied to the district slightly depreciated in illuminating power, so that the test taken at the Corporation works did not actually represent the quality of the gas supplied to the district. They objected to the system of testing provided by the Corporation in the district.

Mr. *Shoubridge* admitted that there was a slight difference; but the quality supplied to the district Mr. Widdowson represented was within the quality they were compelled to supply by Act of Parliament.

Mr. WIDDOWSON contended that there should be a limitation to the profits made; and that such a district as Swinton and Pendlebury should have the option of inspecting the books of the Gas Committee as to the actual profits made every year.

The TOWN CLERK submitted that these objections had little or nothing to do with the present inquiry. The Salford Improvement Act of 1862 provided that the price of gas supplied to consumers by meter should not exceed 5s. per 1000 cubic feet. The Corporation could charge anybody any price they thought fit within that limit.

Mr. WIDDOWSON: We simply wish to draw the attention of the Local Government Board to these objections.

The TOWN CLERK: And they cannot receive the attention of the Board, as they have nothing to do with them in any shape or form.

At the close of the proceedings, the Inspector visited the works.

THE PROPOSED PURCHASE OF THE LONGWOOD GAS-WORKS BY THE HUDDERSFIELD CORPORATION.

At the Monthly Meeting of the Huddersfield Town Council last Wednesday, the minutes of the General Purposes Committee contained a reference to the suggested purchase of the Longwood Gas-Works, to the effect that it had been moved that the undertaking be purchased for the sum of £57,930, with the addition of 10 per cent. for compulsory purchase. After considerable discussion, the motion was negatived. Mr. Brearley now proposed, and Mr. M'Shaw seconded, the following resolution: "That having regard to the suggestions made before the Commissioner, Colonel Ducat, at the time of the inquiry prior to the inclusion of Longwood within the borough, with reference to the price of gas to Longwood consumers, it be an instruction to the Town Clerk to include in the next Bill to be promoted in Parliament by this Corporation such provisions as may be necessary to enable this Council to compulsorily acquire the undertaking of the Longwood Gas Company." Alderman Crosland remarked that the Council would not promote a Bill in this session of Parliament; and if the resolution were passed, it would not be binding on the Council which would be elected before next session. Mr. Brearley, however, moved the resolution after a long speech, in which he contended that the Council were morally bound to purchase the gas-works, in view of promises substantially made to the Longwood people, prior to the incorporation of their district with the borough, that they would enjoy the same advantages as were provided for the rest of the ratepayers. So far from this being the case, in this matter of gas alone, they were paying £400 a year more than they ought to pay through not being able to get their supply from the corporation. Mr. M'Shaw seconded the motion, which was discussed at considerable length. On its being put to the vote, only three hands were held up in its favour.

THE ELECTRIC LIGHTING SCHEME FOR EDINBURGH.

The Inauguration of the Installation.

In our Scotch Correspondent's "Notes" last week, reference was made to the partial inauguration, on the previous Thursday, of the installation of electric lighting which the Corporation of Edinburgh have provided for the city. As already mentioned, it has been designed by Professor Kennedy, the Corporation's Consulting Electrical Engineer; and its construction has been carried out under the superintendence of Mr. A. D. Mackenzie, the Convener of the Electric Lighting Sub-Committee, with the co-operation of Mr. E. W. Monkhouse as Engineer. A central station has been erected at the side of the Caledonian Railway Terminus at the west end of the city. The building, which was designed by Mr. J. Cooper, the Burgh Engineer, is of red sandstone, and presents ornate frontages of 157 and 111 feet to different thoroughfares. A railway siding enters the station by the back. The building is very much larger than at present required, in order to provide for future extensions. Professor Kennedy's scheme for the lighting of the city is to supply the central district by means of the three-wire, continuous-current, low-pressure system; and the districts farther off by a high-pressure, alternating-current method. As yet only provision has been made for the former. A range of six double-furnace boilers, with mechanical stoking worked by an electric motor, provide steam for the engines. These are of the Willans and Robinson pattern, which have now been extensively adopted for driving dynamos. They are coupled direct on to the dynamo, and work at speeds varying from 350 to 400 revolutions per minute. The plant at present consists of two engines and dynamos, of 300-horse power each; two of 250-horse power each; and four of 100-horse power each—in all 1500-horse power. Plant to double this capacity is about to be laid down. There are 212 storage batteries, arranged in two sets of 66 each and two of 40 each. By the plant which has been brought into use, the current is to be supplied at a pressure of 115 volts. When the high-pressure supply is in operation, the current will be sent out at 2000 volts. In the principal streets there are 175 arc lamps, hung on pillars of bracket pattern.

In the afternoon of the opening day, a party of about 500 citizens met, by invitation, in the central station, to see the works. Lord Provost M'Donald remarked that, in all countries, whether civilized or not, the great question was light; and they, in Edinburgh, were about to inaugurate one of the latest improvements in lighting. He hoped the citizens would take very kindly to it, and come forward in large numbers and adopt the new light. In connection with the grand establishment in which they were met, they had invested about £115,000. The Committee in charge of it, under the able chairmanship of Mr. Mackenzie, had applied themselves very closely to their work; and, so far, they had not heard of anyone grumbling that they had not made a fair business of it. The land had cost about £9000; the machinery, about £15,000; the pillars, £6500; the switchboard, £1700; the batteries, £1400; the cables, about £24,000; the castings, £9500; the roadwork, about £17,000—other things making up the total to about £115,000. He concluded by referring in eulogistic terms to Professor Kennedy's work in connection with the installation, and to the services of their own Engineer (Mr. Monkhouse.) Mr. Mackenzie followed. He remarked that those present might inquire what was the use of having so large an establishment; but he

answered that they had had the experience of other large cities in the setting up of electric lighting installations, and, judging therefrom, the Corporation thought it well to provide for any reasonable future extensions. In Westminster they began four-and-a-half years ago with fewer lamps than they were beginning with in Edinburgh, and they had now 180,000 lamps on circuit; Glasgow two years ago set up an installation with 6000 lamps, and they had shortly to make additions to their plant. In Edinburgh, they were beginning with 20,300 lamps of 8-candle power each, and 175 arc lamps in the streets, which were equivalent to 3000 more; other 6000 lamps, they were sure, would be applied for within the next few months, and, in addition, they had the full expectation that, in the course of the next six or nine months, they would have an additional 10,000 lamps applied for. Then they would have to make extensions to their plant. In Aberdeen—a comparatively small town—Professor Kennedy put up an installation to supply 7000 lamps; and three months ago all these lamps were wired. Professor Kennedy had to tell them not to wire any more until they put down additional plant; and they were making their plant three times the size it was at first. In Manchester, they set up an installation 18 months ago, at a cost of £160,000, to supply 80,000 8-candle power lamps; and now they had 70,000 lamps wired. He did not see that there should be any necessary antagonism between electric lighting and gas lighting. He admitted that the former would, light for light, be a little dearer—perhaps 25 per cent.—than the latter; but there were many economies which could be practised in the use of electric lighting. Professor Kennedy congratulated the Corporation upon having passed so many of their difficulties. He said he really did not think there was any place in the United Kingdom, other than London—and he was not sure even of London—which offered the same probability of success as Edinburgh. It was a compact city, with a residential district, a business district, a shop district, and a hotel district all close together—the best possible conditions for making electric lighting financially successful. He did not think any other city started with anything like the number of lamps that were already applied for in Edinburgh.

The members of the Corporation, together with the officials of the electric lighting undertaking, and representatives of the various contracting firms, subsequently dined together in the Rutland Hotel, under the chairmanship of Mr. Mackenzie. After the toast of "Success to the electric light undertaking" had been honoured, Mrs. M'Donald switched on the current, and the light appeared in all the lamps in Prince's Street. Replying to the toast, the Chairman stated that the financial success of the undertaking was actually secured already. When Professor Kennedy reported to them, he went into the calculations very thoroughly, and showed that, when they had 20,000 8-candle lamps wired, the current would cost them 7d. per unit. He then went on to show that, when they had 40,000 lamps burning, the current would cost them only 4⅜d. They had arrived at the first stage very much sooner than Professor Kennedy anticipated; and they were now progressing along the second stage of the journey. He was confident they would be able, within the next nine months, to supply the current at 4⅜d. per unit, even with the increased expenditure. In regard to street lighting, they had promised all along that Prince's Street would be, as in other things, the finest street in Europe; and he had been told, by those who had seen similar undertakings, that there was nothing to be compared to the lighting of that street. It would cost them £620 to light it, which was about £200 more than it cost by gas. But then they had ten times better light; and this would tend to the prosperity of the city. The large firms who had their business premises towering to the skies would receive the benefit; and tourists, who came in shoals in August and September, would have the dollars drawn out of their pockets by the electric light, and everybody would be happy.

ELECTRIC LIGHTING NOTES.

The consideration of the long-delayed report of the Electric Lighting Committee, and their surprising recommendation as to future work, was the principal business of the St. Pancras Vestry at their meeting last Wednesday. The report, which was presented by the Chairman (Mr. Sweet), stated that, after paying all charges for repairs and maintenance and a sum of £5379 for interest and repayment of loans, there was a net profit on the year's working of £1754, which, with £14 carried over from 1893, made an available balance of £1768. Of this amount, £554 was written off capital account for preliminary expenses, and £1214 carried forward. Mr. Menzies maintained that the result showed a return of nearly 6 per cent. on the capital; and he pointed out that, had the electric lighting of the parish been an ordinary commercial affair, its £5 shares would be worth £6 10s., and the whole concern could now be sold at a profit of £30,000. With regard to the question of creating a reserve fund for depreciation, the Committee were of opinion that the amounts paid annually off loans were, in reality, equivalent to setting aside a sum for this purpose. As a matter of fact, St. Pancras paid off nearly 2 per cent., which was equal to the sum set aside for depreciation by three London Companies. He admitted that, in comparison with gas, the electric public lighting was more expensive; but the light was nine times greater. Gas at the same power would come to 2½ times as much as the electric light, which had only cost the ratepayers an increase of ¼d. in the pound for the year. The electric light undertaking had been called "a costly toy;" but if it was one, he only wished he had a few more to deal with. Replying to a member, Mr. Menzies stated that the electric light cost £2000 more per annum than gas. The accounts were passed.

The Vestry proceeded to consider the following recommendation of the Committee: "That, on the completion of the works at present in hand at King's Road station and elsewhere, the services of the Consulting Engineer be dispensed with, and that the Vestry appoint a Chief Electrical Engineer, competent to manage the whole of the Vestry's generating and distributing stations and mains, and to design and carry out all extensions and new works; and that the salary attached to the office be £600 per annum." The Committee reported as follows: "In consequence of several explosions that have taken place in districts where the Vestry's electrical mains are laid, investigations have been made as to the cause, and as to the best means to be taken to prevent a recurrence of them in future. In the course of the inquiry, your Committee became aware of serious difficulties involved in the dual responsibility exercised by Professor Robinson, the Consulting Engineer, and Mr. Baron, the Chief Engineer; and this method of working having proved very unsatisfactory, your Committee are unanimously of opinion, after much deliberation, that the time has now arrived when the best interests of the Vestry will be served by the appointment of a Chief Electrical Engineer." The recommendation having been formally moved, Mr. Purchese, the Chairman of the Works Committee, thought the Vestry ought to have some information as to the cause of the friction. Professor Robinson had been put in an exalted position; and to send him about his business would infer incompetency. Mr. Sweet was indignant at Mr. Purchese's suggestion. He said the alteration would mean a considerable saving; and Professor Robinson had done the work for which he was engaged. Mr. W. J. Wetenhall maintained that there was more behind the scenes than the Vestry knew. The Committee had hushed up something. Their statement was too vague to warrant such action as that suggested. They claimed to have made a profit, yet they proposed to change their officer. In justice to Professor Robinson, the Vestry ought to know the facts. Mr. Lacey explained that the Committee thought it wiser to employ one head official, who could be held responsible for explosions, &c., rather than have the present dual control. Dr. Bell said it was evident there was a great deal of "friction." Mr. Hodgkinson moved, as an amendment, that the recommendation be referred back, and that copies of Professor Robinson's reports be sent to each member of the Vestry. Mr. Menzies indignantly described these reports as "private and confidential," and said he was sure the Vestry would find it difficult to follow them, or to appreciate some of their points. After more wrangling, the amendment was lost. Mr. Boden moved, as a further amendment, that the resolution should commence from the words "That the Vestry appoint a Chief Electrical Engineer," &c., omitting all direct reference as to "dispensing" with Professor Robinson's services. Mr. Macgregor wanted to know the cause of all this mystery. He maintained that it was a dismissal of Professor Robinson, cover it with sugar as much as they pleased. "Why," he asked, "discharge a man who is responsible for a 6 per cent. profit?" After further discussion, the amendment was carried, on a division, by 32 to 28, and was afterwards passed as a substantive motion. The question why Professor Robinson is to be "shelved" remains unanswered.

After giving Mr. W. H. Preece his *quietus* a few weeks since, the Hampstead Vestry relegated his duties to Mr. R. A. Chattock, their own Electrical Engineer; and now this gentleman has upset their arrangements by accepting a more lucrative appointment under the City of London Electric Lighting Company, and his resignation was tendered at last Tuesday's meeting of the Vestry. A long discussion ensued as to the salary to be paid the new Engineer. The Committee recommended £300. [Mr. Chattock only had £200.] But Mr. Richardson pointed out that the St. Pancras Vestry and other bodies paid £600; and he moved that the commencing salary should be £350. Mr. Watts thought the smaller sum would be adequate, until the gentleman's qualifications had been fully demonstrated. Mr. Dobbs declared that Mr. Preece himself had recommended the Vestry not to pay more than £200; Mr. Johnson retorting that Mr. Preece had then imagined he would himself continue to be their Engineer. They could not expect their new officer to do for less than £350 a year such work as Mr. Preece had an overriding commission of 4 and 5 per cent. for. It would be true economy to pay a good salary. Eventually, advertisements were authorized offering £300 to commence. Another matter affecting Mr. Preece was reported by the Committee, who have informed him, in reply to his letter, that the intention of the Vestry is that their own Engineer shall prepare plans and estimates for, and superintend the carrying out of, all extensions of the electric lighting in the parish; but that, "in the event of any difficulty occurring, they will be glad to have his opinions and advice upon such terms as would be mutually agreed upon." Later, the Vestry decided to divide up the cable network for electric lighting, at an estimated cost of £300, so that if an accident occurred in one section of the parish, the others would not, as at present, be affected. This decision was not arrived at until Mr. Johnson had expressed his surprise that the gentleman who had received so much money from the Vestry had not discovered this advantage when the mains were originally laid, and not left it to his successor to find out. No notice was taken of this remark, nor of Mr. Watts's inquiry as to when "a full statement of the electric lighting affairs of the parish" is to be submitted to the Vestry.

The peculiar position which the Croydon Corporation have taken up in regard to electric lighting will be watched with considerable interest. They want the light; but they are anxious not to run any financial risk. Last October, it was decided that arrangements should be made with a Company of undoubted stability to establish an installation for the compulsory area, at such a contract price as the Consulting Engineer of the Corporation may approve; that the Corporation should find the necessary capital for the purpose; and that the Company should undertake to work and maintain the installation for a term of years, taking the revenue, and guaranteeing to pay the Corporation interest and sinking fund on the capital expended—power being reserved to the latter to take over the concern, upon agreed terms, at an earlier date than the expiry of the period stipulated in the first instance. Since then twelve companies and firms of electrical contractors have been invited to make offers to the Corporation on the above basis; and six have responded. Their tenders have been submitted to Professor Kennedy; and he reports in favour of the British Thomson-Houston Company, Limited, whose contract price is £15,986, to which will have to be added an uncertain sum for the provision of meters, service-boxes, connections, &c. The Company, however, are of opinion that £21,000 will be sufficient to provide a complete system for dealing with the compulsory area, including professional expenses. The General Purposes Committee have, in consequence, recommended the Council to apply to the Local Government Board for sanction to borrow a sum not exceeding £27,500, and have also asked, for power, in the event of the Thomson-Houston Company not being willing to make a contract for carrying

out the revised specification at a price which is satisfactory to Professor Kennedy, to open negotiations with another firm. These recommendations were brought before the Council at their last meeting by Alderman Miller, who informed his colleagues that it had been arranged for the Company supplying the light to do so at a maximum charge of 6d. per unit, which "compared with gas at 3s. per 1000 cubic feet." Alderman Morland, pointing out that the Company would only require £21,000, asked what would happen with the balance. Alderman Miller replied that if the £6500 was used for extensions, the Company would pay interest and sinking fund upon it; but if not required, they would not pay. It was also stated that the generating station is to be situated near the gas-works at Waddon. The recommendations were adopted.

The electric light is not making very rapid progress at Southampton. The Company commenced operations in 1891; but at the end of December last, they were only supplying 3896 lamps, which, with two cranes, required 85,501 units of electricity. The revenue derived from this output was £2491, of which £1676 was absorbed in expenses. The net profit in hand amounted to £1014, which, after setting aside £100 for depreciation, £100 for Directors' fees, and paying interest on loans and debentures, and writing off the balance of the loss last year (£184), was reduced to £138. This will allow the payment of a dividend of 6 per cent. per annum on the preference shares and of 2½ per cent. on the ordinary shares. At the recent meeting of the Company, the Chairman claimed a "record" in the cost of production. He stated that their cost was 4·44d. per unit, as against an average of 4·78d. for six other towns. But in the list which he quoted, Eastbourne figured at 4·22d., and Northampton at 4·42d. The places he referred to were Cambridge, Eastbourne, Hove, Northampton, Notting Hill, and Scarborough; and in all of these (except Northampton), the output is considerably more than at Southampton—Eastbourne standing at the head with 147,000 units, as against 85,501 for Southampton.

The Gas Commissioners of Kingston, Jamaica, are about to start in the electric lighting business, by utilizing the water power to be obtained at Constant Spring, about six miles from the town. By storing the water, there will be sufficient force to work six turbines of 100-horse power each. There is a prospect of a demand for electricity for tramcar traction, as the local Car Company have expressed their intention of using electric motors. But the Gas Company are opposing this, on account of the injury which is likely to occur to their pipes; and possibly there will be other objectors, as the water and drainage pipes would be equally affected. These objections would, of course, be removed by the use of gas as the motive power.

Richmond (Surrey) Water Supply.—The Richmond Town Council at their last meeting adopted minutes of the Water Committee in which reference was made to a report by Mr. Whitaker on the subject of the adits in the Terrace Garden well, and one by Mr. C. Hawksley on the water-works generally. The Committee stated that the result of carrying out a recommendation of Mr. Whitaker had been to obtain an increase of water to the amount of 15,000 gallons a day, representing an income of £273 a year, at an outlay of £700. Mr. Hawksley's report confirmed Mr. Whitaker's views as to continuing the driving of adits, and contained in addition some valuable suggestions. In view of the present proceedings in Parliament, the Committee recommended that the consideration of the subject be adjourned. They also appended some figures showing that, whereas for the year ending March 31, 1896, the annual loan charged on account of the water-works was £5395, which involved a rate of 7d. and a fraction, this would be reduced in 1910 to £642, or a rate of a fraction of a penny; and in 1916 the loan charge would be reduced to £22 6s. 5d., at which it would continue until 1942.

Odessa Water-Works Company.—The Directors of this Company report that the water-rents for 1894 amounted to £58,404, against £53,787 for the previous year. The total revenue from all sources was £64,754; and the expenditure, £33,392. The third law suit referred to in the report of last year, in respect of the price to be charged for the household supply of water for the years 1889, 1890, and 1891, has been disposed of; the decision (which is final) being against the Company. Accompanying the report is the translation of a report by the Commission appointed to consider the question of the water supply of the town. This document was presented to the Douma on March 26 last, when the proposals of the Commission were carried by a majority of 29 to 10. In this report practically two proposals are submitted for the consideration of the Company. They are, shortly stated: (1) To pay to the Company an annuity during the remainder of the concession equal to the net annual revenue on an average of five years. (2) To purchase the undertaking for a lump sum upon the basis laid down by the 44th paragraph of the concession, which is as follows: "The town reserves to itself the right after the expiration of twenty years from the date of the termination of the period of two years fixed for the carrying out of the work and for the commencement of water supply from the works, to acquire, at any time, the whole of the water-works. This redemption is to take place by capitalizing the redemption price at 5 per cent. on the average amount of the annual net proceeds for the last five years. But if less than twenty years remain till the expiration of the period of concession, the redemption price is only to be paid for the last years of the concession on the average amount of the annual net proceeds for the preceding five years." That sum is taken to be the net proceeds which remained from the gross receipts, after deducting from the latter all expenses of maintenance, keeping in repair, administration, and working the undertaking, and the guarantee refunded. The Directors are of opinion that the only course which will solve the question with the least friction to both parties will be to adhere to the basis laid down by the 44th clause of the concession, which gives the right of pre-emption to the Municipality, the starting point of which would be to ascertain what is the net revenue for the years 1890, 1891, 1892, 1893, and 1894; and every other point would then become a matter of detail. The Directors fear that any departure from this course would probably be attended with considerable difficulty and possible unpleasantness. The payment of a dividend of 6s. per share to the "A" shareholders is recommended

LONDON WATER COMPANIES AND THE SUPPLY OF WATER IN THE SUBURBS.

The Lambeth Company's Bill—Consumers' Demands—Supply of Kingston.

The Surbiton District Council are opposing the Bill of the Lambeth Water Company; the two principal points which they wish to gain being: That the Company shall lower all the pipes in the district; and that they shall take proper steps to purify the effluent water in which they wash their sand without doing injury to the river. At the last meeting of the Council, the Chairman (Mr. T. Guilford) expressed his belief that the Company would concede both these proposals rather than the Council should oppose them; and he read a letter from the Secretary of the Company (Mr. H. Wilkins), in which it was stated that the Directors were quite willing to submit the following clause: "The Company shall not allow any water used for their sand-washing operations to flow into the river in such a state as to unduly discolour the water." With regard to the depth of the mains, the letter added that the Directors were anxious to meet the Council; but the Secretary thought they would readily see the objection to any specific depth being mentioned in an Act of Parliament, whether generally or for any particular locality. The Company had already relaid some of their mains in Surbiton in a 3-feet trench; and the Directors authorized him to give their assurance that all new mains should, wherever practicable, be laid in a trench of that depth, until further experience had been gained. If this proved satisfactory, the Directors were further prepared to assure the Council that all mains now laid at a less depth should, where practicable, be laid in a 3-feet trench as they required renewal. After the reading of the letter, the Chairman, in reply to a question, intimated that, until the Company yielded to the demands of the Council, they would continue to oppose the Bill.

A private conference of between seventy and eighty customers of the Lambeth and Grand Junction Water Companies, residents of Kingston, Surbiton, Hampton Wick, Teddington, and Twickenham, has been held, to discuss the steps to be taken in reference to the recent water supply difficulties. The deliberations of these gentlemen have resulted in the production of a body called "The Water Famine Committee," who have issued for the signatures of consumers in the districts named the following modest requisition: "To the —— Water-Works Company. We, the undersigned water-rate payers, beg to bring before your notice the enormous inconvenience and expense to which we have been put during the late frost, for a period varying from six to nine weeks, and to request as follows: (1) That you will remit the water-rate during the period of non-supply. (2) That you will re-imburse us respectively the extraordinary expense to which we have been put in consequence of such non-supply. (3) That you take immediate steps to lower such of your mains as are not of a sufficient depth to be safe from frost, and thus obviate the serious dangers to health and from fire to which we have lately been subjected."

At a recent meeting of the Kingston-on-Thames Ratepayers' Association, Mr. Hall called attention to the late "breakdown" in the supply of the Lambeth Water Company, and moved a resolution expressing the opinion of the Association that the time had arrived when the Corporation should consider the advisability of introducing a comprehensive scheme for an independent water supply throughout the borough. He congratulated the Town Council on the active measures taken by them during the recent frost to endeavour to supply the needs of the townspeople. They incurred considerable expense, and were looking to the Lambeth Company to recoup them, which he believed they had refused to do. The Grand Junction Company had expressed their intention of recouping the authorities through whose districts their mains passed for any expense that might have been incurred; and he only wished the Lambeth Company had shown the same amount of intelligence and enlightenment. It seemed to him that they were almost incorrigible—at all events, they were not prepared to listen to reason when their pockets were touched; and it was time this great monopoly was broken down. Mr. Adamson suggested that the Member of Parliament for the division should have his attention called to the question, and that the Association should send him a copy of the resolution, that he might bring the matter before the House of Commons. Mr. Clarke stated, in reply to a question, that there were about 32 stand-pipes in the borough during the frost. The Chairman (Mr. C. H. Burge) asked Mr. Hall to add the following words to his resolution: "and that, pending fuller action, a constant water supply shall be at once demanded from the Water Company." He said it appeared to him that one of the first steps that should be taken by the Corporation was to secure a constant water supply. It was the fault of the Corporation that they did not possess it already; and he thought they ought to press the matter forward. Mr. Hall accepted the Chairman's addendum; and the resolution was carried.

THE LONDON WATER COMPANIES AND THE FROST.

Local Government Board Inquiries.

As briefly mentioned in the JOURNAL last week, the second of the series of inquiries which are to be conducted by Major-General A. DE COURCY SCOTT, R.E., relative to complaints addressed to the Local Government Board respecting the deficient supply of water consequent upon the recent severe frost, was opened on the 11th inst., at the Offices of the Wandsworth District Board of Works. The complainants in this case were consumers of the Southwark and Vauxhall Water Company.

Mr. W. B. TANNER, Solicitor, and Mr. J. W. RESTLER, M.Inst.C.E., the Engineer, appeared for the Company; Mr. W. W. YOUNG, Solicitor, for the Wandsworth District Board of Works; Mr. E. TANNER represented the London County Council; and Mr. W. G. THORPE attended on behalf of the memorialists.

The INSPECTOR, having stated the authority under which he was holding the inquiry, proceeded to read the memorial, which was signed by Mr. W. G. Thorpe, F.S.A., and 20 householders. It set forth that,

owing to the Company's mains having been laid at a depth insufficient to guard against frost, the memorialists had been from six to eight weeks without any water supply, except such as they had had to fetch at their own expense; and it then stated as follows: "The Company have not used due diligence to restore the supply and repair defects in what is clearly a worn-out and rotten pipe service. Further, as a neglect in the performance of a statutory right, they are, we submit, legally actionable; and, in view of the sanitary effects which follow upon insufficiently-flushed house drains, we request that your Department may, if thought advisable, indict the Company for such neglect. We also ask the appointment of an inspector to examine into these facts, and generally give such relief as your wisdom may think suitable." He then called upon Mr. Thorpe to state his case.

Mr. THORPE said that some of the memorialists thought the facts had been so thoroughly and clearly proved in the Lambeth water-works inquiry on the previous Tuesday, that it was not necessary to sacrifice further time, especially as the holding of the inquiry during the day raised great difficulty; and he suggested that the inquiries should be held in the evenings, and at a more convenient place to memorialists.

The INSPECTOR said he would take that matter into consideration.

Mr. W. B. TANNER expressed a hope that, if it were the opinion of his Company that they should appear by Counsel, it would be allowed.

The INSPECTOR stated that he had written to the Lambeth Water Company that, if they considered it necessary for the proper representation of their case that Counsel should be employed, he had no objection to it.

Mr. THORPE then said he would not adduce the fact, which he thought was abundantly proved and admitted by Mr. Shaw Lefevre in the House of Commons—viz., that the quantity of the water had been lamentably deficient. What he would propose to show was that there had been such neglect on the part of the Company as to oust finally the unavoidable causes mentioned under the 10th Vict. cap. 17, sections 36 and 42. He would suggest that General Scott should avail himself of his statutory powers to have certain pipes taken out and examined, in order to see whether or not his (Mr. Thorpe's) contention was justified. The items of neglect which he submitted as being other than unavoidable causes were that the mains laid many years ago were originally too weak for the strong services that had been subsequently applied to them; and that they had not been maintained in the way that they ought to have been by persons having charge of a statutory duty and a statutory right. Further, he would submit that they had not used due diligence in repairing their breakages. He had been told by one of their own people that they had not sufficient pipes in stock; and consequently they were unable to do it. He submitted that this was a case of neglect, because they were bound to foresee this; and he would put it that this neglect amounted to criminality.

The INSPECTOR suggested that Mr. Thorpe should give his evidence in a formal manner, and be subject to examination.

Witness then proceeded to state that for 27 years he had been the lessee of No. 20, Larkhall Rise. Till the 8th inst., he had been for eleven weeks without any water supply, except that brought by hand at his own expense; and further, the Company had taken no notice of his strong complaint. He had gone over several streets (which he named); and he stated that the pipes in many cases were only 6 inches below the ground. When they burst, they were allowed to remain unmended for days. When all the pipes were "cobbled" up, other bursts took place within a very few feet, showing that there were points in the system close by which were very little stronger than the original weakened places. He would produce evidence from one of the Company's workmen, to show that the pipe service had been degraded—that is, not kept up. The pipes had worn-out places in them; and they went at the weakest point when strain was put upon them. The workmen said the pipes had seen their day, and could not bear the pressure to which they were subjected. The turncock stated that the reason for there being no supply to certain houses was that, owing to the weakness and breakages in the pipe service lower down Larkhall Lane, they dare not put pressure sufficient to supply his house, which was at the top of the hill. There had been a fire in the Gauden Road; and the engines had to wait 20 minutes idle through want of water. Six people leapt out of the windows; and one person was fatally injured.

The INSPECTOR asked for particulars with regard to witness's communication-pipes.

Witness: As soon as the frost was over, I had my pipes restored; but there was no water in the mains—I could not get it.

Mr. RESTLER said that if any point were raised as regards the fire, they would be quite prepared to call members of the Fire Brigade, because the evidence on that point had already been given before the Coroner on oath; and it was at total variance with the statement made by the witness.

Witness: I object to these *ex parte* statements. You are on your trial.

Mr. *Hornell*, a barrister, residing at No. 36, Larkhall Rise, was the next witness. He stated that on Feb. 9 the water supply ceased for a week or ten days. Before that there was no high-service supply. The first water that came into the house was on March 19. The Company's water-cart was sent round; but the whole thing was a farce, and the man declined to stay any time, saying that two buckets were enough. There was a stand-pipe opposite his house at the commencement of the frost. But it was taken away; and they had to go some distance to another stand-pipe, which was only open in the morning.

Mr. *G. Carr*, representing Mrs. Charlotte Sainsbury, the lessee of No. 50, Larkhall Rise, said that from Feb. 2 to March 23 they had not had any water in their cisterns. The depth of the Company's mains in front of his house was about 12 inches; and the communication-pipes to the house during the last three months had been absolutely sound. Bursts in the mains occurred daily; and in one or two instances, he had seen the same spot in the road opened several times for repairs. Clapham Old Town had been flooded repeatedly from bursts in the mains.

Mr. *J. Gillespie* said that from Feb. 12 to March 22, he had no water in his cisterns; and during all that time, they had to pay for the water brought into the house. He had seen the pipes opened for repairs all the way from Larkhall Rise and Rectory Grove to the Common and the Old Town; and the pipes seemed to average from 6 to 12 inches in depth from the surface. Those that were being mended and repaired appeared to be thoroughly worn out. This was owing to the length of time they had been in the ground. Whoever took over the pipes would have to lay down new ones.

The INSPECTOR asked the Solicitor to the Water Company if he proposed to postpone the cross-examination of the witnesses.

Mr. W. B. TANNER: Yes; and then we shall be able to deal with the whole subject of this particular memorial.

Mr. *A. Southam*, Surveyor to the Wandsworth District Board of Works, who gave evidence at the inquiry on the preceding Tuesday (*ante*, p. 808), then proceeded to refer to the district covered by the memorialists represented by Mr. Thorpe. He stated that he had had openings made on the previous day at the mains and service-pipes in two places in Larkhall Rise. The depth of the main at Mr. Thorpe's house was 7 inches only; 10 inches, to the service-pipe under the footpath; and 12 inches, at the side of the stopcock. Witness then gave further details of the condition of the mains and communication-pipes—the former from his own inspection, and the latter from reports made to him by the consumers.

The INSPECTOR: Are any of these consumers who have furnished this information coming forward to give it on their own account?

Mr. YOUNG: That raises an important question. The Board have received an enormous number of communications from people who have not memorialized the Local Government Board. Some of them are very desirous of giving evidence; and the question is whether you would admit such evidence. I submit that they should be heard.

The INSPECTOR: I do not think I can go into the question of other complaints against the Company as apart from those made by the memorialists. I will receive to a certain extent evidence with reference to the condition of the Company's mains, and the question of leakages even in communication-pipes; because those leakages, whether in the mains or the communication-pipes, would actually or very probably affect the supply to the memorialists with whose case I am dealing. I do not propose in this particular petition to go into evidence of complaints apart from those which are proper to the memorialists who signed the petition.

Mr. YOUNG asked whether persons living in the district, whose names were not in the memorial, would be allowed to give evidence.

The INSPECTOR: I must exercise my discretion upon that. What is present in my mind is this: We have a particular group of the inhabitants of your district included in this memorial who complain that the supply is deficient in quantity. If there was a deficiency (and this remains to be proved), there are causes which may have led to that deficiency which cover a considerable area outside this locality altogether; and persons independent of the Company might give evidence as to breakages in the Company's mains—for instance, in the streets at a distance—which might affect the supply to these memorialists. There may be general evidence given of a very large number of breakages; and, in consequence of leakage, it might be impossible to drive the water to the locality of these memorialists.

Mr. YOUNG submitted that an inhabitant could not give that kind of evidence. It could only be done by the Water Company, who knew what parts the mains supplied.

The INSPECTOR: If he states that there are breakages, it remains for me to find out from subsequent inquiry whether the breakages in that line of pipes would be likely to affect these particular memorialists. I will receive evidence of bursts of the Company's mains from the Board's witnesses who have not signed the memorial, so far as I think it would affect this particular locality.

Mr. YOUNG: But not the evidence of persons who have been without water from some cause or other?

The INSPECTOR: No.

Mr. THORPE submitted that General Scott's powers under the Act were ample to admit persons to give evidence who were not memorialists; and in a case like this, where it was a matter of life and death and of future pestilence from half-choked drains, he hoped the Inspector would exercise the largest discretion in admitting such evidence.

Mr. W. B. TANNER pointed out that the words of the section were "to inquire into and concerning the grounds of such complaint." The complaint he presumed to be that named in the memorial; otherwise they would have an enlarged inquiry to go over the whole district, and he did not know when they would get to the end of it.

The INSPECTOR: There are a certain number of complaints and distinct memorials with reference to the district of this Company; and I think you will find, if they are gone into in any number, they will cover practically the whole question that is involved as to the condition of the water supply generally.

Mr. *Southam's* evidence was then further proceeded with. In answer to the Inspector, witness stated that there was an enormous amount of leakage from the stand-pipes. In many instances, the main became frozen; and the stand-pipes were then removed, and the supply given by means of water-carts, commencing on Feb. 16 and ending on April 8. At the beginning of the frost, a number of stand-pipes were placed, which one by one failed—leaving only a few that could be used where water could be obtained; and the deficiency in the supply was made up by distribution from water-carts. He was speaking of a particular district, within a radius of half a mile of the petitioners' neighbourhood, where there were so many bursts that the water had to be shut off from the mains in order that the pipes might be repaired. There was no water in a great number of the mains in this locality. The water was now being gradually restored; but all the mains were not yet supplied. The mains generally were at a very shallow depth.

The INSPECTOR: Can you give a specific average, or anything of that sort?

Witness: The average, possibly, is about 1 ft. 3 in.

In examination by Mr. THORPE, who asked whether, having regard to the pressure to which the burst pipes had been subjected, they were originally sufficiently strong for their purpose, witness replied that they were strong enough originally; but they had been down a number of years.

Were they practically worn out and badly jointed?—I could not say that.

There is supposed to be a constant supply, is there not?—In the area that we are now dealing with, I believe it is so.

Has it been reported to you that, on one occasion, the constant supply was turned off, with the result that the main became stagnant, and hence froze?—Yes.

Mr. W. B. TANNER said he did not wish to raise any objection to Mr. Southam's evidence; but it was of such a general character that it was almost impossible for the Company to meet it without a little more detail. According to his instructions, Mr. Southam had travelled a good deal farther than what the Company considered to be the "district." They defined the district as the main which supplied the particular houses in which the memorialists resided. If Mr. Southam had travelled over a locality of a quarter of a mile round, he might have touched upon localities or houses which had nothing to do with what was termed the "district," from the Company's point of view.

The INSPECTOR: The evidence must go for what it is worth in this particular case.

Mr. TANNER: It places us in a difficulty in furnishing such information as you would naturally expect us to give.

The INSPECTOR: I propose to ask you for definite information with reference to the condition of your mains, to learn where these burst pipes exist, and where they do not; because we shall assume that, where there is no specific statement that the mains have burst in particular places, there are none in those places.

Mr. TANNER said that, on their resuming the inquiry, he should be prepared to meet the statements as far as possible.

A discussion then arose as to the adjournment.

Mr. YOUNG stated that he should be ready with his memorial for the Wandsworth District Board against the Lambeth Water Company on the 25th; and if the inquiry in regard to the Southwark and Vauxhall Company were taken on the following day, he should be prepared with his memorial against that Company.

Mr. TANNER asked if it was proposed to deal with each memorial separately against each Company.

The INSPECTOR: Yes; there will have to be a decision on each separate memorial. I should like to have general information to apply to all the memorials in your district.

Mr. TANNER said there was a certain amount of definite information which the Company could not supply until they heard what the memorialists had to say.

The INSPECTOR: But if I have a general statement as to the condition of your mains, and so on, it can be referred to in the case of every memorial.

Mr. TANNER: Yes, undoubtedly. But, looking at the memorials already gone into, we shall want more definite information than is contained in a general statement.

The INSPECTOR: If you prepare a schedule of your bursts over your whole district, that would be a document from which extracts could be made with reference to every memorial.

Mr. TANNER said he did not know that it would be possible to make a general report upon the whole, and at the same time deal with the particular district of the memorial.

Mr. RESTLER said a report could be made on the whole district; but it would take a long time to prepare, because the information was not yet tabulated—the number of bursts caused by the frost being so enormous that they had not really been able to get it into shape. He thought the memorial of the Wandsworth District Board covered the area of the other memorialists; and if a report were made on that, it might suffice for all.

Mr. C. BULLARD said that, as a member of the Wandsworth Vestry, he had sent in a petition on behalf of a number of working-class residents; and he desired to be heard at that sitting.

The INSPECTOR explained that this could not be done, as notice of the inquiry had to be sent to the Company, and each memorialist had to be separately written to. He and the other memorialists would have due notice to appear.

The inquiry respecting the complaints from the district of the Southwark and Vauxhall Water Company was continued last Thursday. Two sets of memorialists had been summoned to lay their cases before the Inspector; and, as a matter of convenience, two Surveyors of the Wandsworth District Board (who have a separate memorial referring to the whole district) submitted evidence as to the condition of the water supply in the districts covered by the petitions.

Mr. *J. C. Radford*, the Surveyor to the Wandsworth District Board for Putney and Roehampton, gave evidence in respect of the petition of Mr. H. W. Crosse and others. He stated that he had had the ground opened opposite all the houses of the memorialists in the Putney district, and had taken measurements from the surface of the ground to the tops of the mains and communication-pipes and at the stopcocks. The result was shown in a tabulated statement which he put in. From this it was seen that, in one case, the depth of the main was 3 ft. 2 in.; and the next greatest depth was 2 ft. 3 in. The figures varied from this latter measurement down to 1 ft. 1½ in. As to the communication-pipes, the depths ranged from 11 inches to 2 ft. 1 in.; and in one instance, the pipe was 3 feet below the surface. The depths at the stopcocks were from 1 ft. 1 in. to 1 ft. 11 in. In various places where the pipes had burst—not in this particular district—witness had taken samples, and found that in nearly all cases the pipes had burst in a straight line on the top. Speaking as to the whole parish, he said the bursts had been very general. Some of the pipes were not more than 1 foot deep; and they varied up to 2 ft. 6 in. The total number of burst mains in the Southwark Company's district in the parish of Putney was 213. A great number of communication-pipes had also burst; but he had not taken any account of those. There were three places in Putney still without water; but with these exceptions, the Company's mains had been repaired, and, so far, they had been able to give a supply.

Evidence on the memorial of Mr. Edward Olney and others was next taken. The memorial (dated March 19) stated that, for more than six weeks, the petitioners had been without water; and their condition from a sanitary point of view was an exceedingly dangerous one. The Water Company had informed them that the stand-pipes were out of order; but the memorialists had not heard of any effort being made to repair them.

Mr. *C. Hunt* (one of the memorialists) was called, and spoke of the inconvenience which they had suffered from the breaking up of the frost until the present time. The water cistern at his father's house was even now useless, because the pressure was insufficient for the water to reach it.

The INSPECTOR: Did you get a supply during the frost?

Witness: Yes. We have water now in the main; but often it is too filthy to use.

Mr. *Olney* was next examined. He believed that his house was without water for about seven weeks. He had his pipes examined as far as the stopcock, and found them in perfect order. The Company informed him that his examination must be carried beyond the stopcock, and that he must obtain power from the Local Board to take up the pavement. He thought this very unreasonable; and he obtained the opinion of an expert that it was not his place to remove the pavement, and open the public road. As to the measures taken to supply the consumers, the Company's water-cart came very irregularly. They had a stand-pipe for five days in his road; and the residents were then informed that it could be no longer used as the main had burst. They had then to go about 250 yards to procure water.

Questioned by Mr. TANNER, witness said he could not tell whether the main in his road (the Granville Road) was frozen. He only knew that the stand-pipe was removed; and the residents were told that it was impossible to obtain any more water from it.

Mr. TANNER: We can prove that the main in that road was never frozen at all.

Mr. *A. G. Higgs* stated that he had been without water from the commencement of the frost until a month ago. A water-cart called every day; but the water was of a bad colour, and unfit for drinking.

Mrs. *W. C. Blow* gave similar evidence.

Mr. *P. Dodd*, the Surveyor to the Board of Works for the parish of Wandsworth, gave the depths of mains and communication-pipes at several places. There were 41 bursts of mains in the Merton Road, and five leakages. He had applied the term "bursts" to where the water was seen running from the mains that had been exposed; and "leakages" to places where they had not ascertained whether they came from the mains or the service-pipes. The total number of burst mains in Wandsworth in the district supplied by the Southwark and Vauxhall Company was 185; and the total number of leakages was 228. There were a number of stand-pipes in use when he made his official inquiry.

Mr. RESTLER stated that the Company still fixed stand-pipes for the convenience of those people who had not yet had their fittings repaired.

Mr. *C. Hover*, a baker, was next called, and stated that he was without water from Feb. 9 to April 4.

This concluded the evidence.

Mr. TANNER said, with reference to the memorial of Mr. Crosse, that there was no one to support it except Mr. Radford (whom he had allowed, out of courtesy, to give evidence); and he submitted that General Scott could not therefore deal with it.

The INSPECTOR said he looked upon the Surveyor's evidence with regard to bursts—whether or not the bursts occurred in a particular district referred to by the memorialists—as a matter affecting, very probably, the question of the supply of water to the memorialists' district, although it did not happen to be within their district.

Mr. TANNER: But I take it you are dealing with the memorials separately in a measure; and it does not rest with the Surveyor of any particular parish to come forward, and make statements, unless it is to support some memorial.

The INSPECTOR: It rests with me to ask the Surveyor or anybody else for information with regard to the question. I shall have to deal with these statements from an expert point of view. I understand an arrangement is made for the local authority and the Company in conjunction to take the pressures.

Mr. HILLS: That is so.

Mr. RESTLER: If you like to take every hydrant, so far as we are concerned, we should be prepared to give facilities.

The INSPECTOR: Could a statement be arranged for each division or sub-district and for each street, showing the number of pipes belonging to the Company which were fractured during the frost, the total length of the pipes in such street, the nature of the surface material, the nature of the subsoil, the dates on which the repairs to the pipe-lines were completed, the depths at which the new pipes were re-laid, the number of notices for repair to communication-pipes served in each street or road, the average depths of the communication-pipes at the points of bursts, and any note which might be made on the maximum observed depths of these bursts?

Mr. RESTLER: It would certainly take months before that information could be given in a form acceptable to you. We shall have it; but it will take a long time to get.

The INSPECTOR: Yes; but it will have to be got out somehow.

Mr. RESTLER: All that the Company have done up to now has been to reinstate the supply. There are a large number of pipes which have been damaged below ground which have not burst sufficiently to be removed, but which will be replaced as time goes on.

The INSPECTOR: I quite understand that. But still it will be necessary to have a comprehensive view of the whole condition of the system sooner or later in some form. I do not mean to say that it should be absolutely complete; but it should be sufficiently complete to draw conclusions from as to the effect of the frost on the pipes, and, in fact, generally speaking.

Mr. RESTLER: We should be quite prepared to give the whole of the information; and the only thing is to ask you not to fix too early a date for its production.

The INSPECTOR: I merely mention it now in order that, as the ground is being opened, the opportunity might be taken of getting information.

The inquiry was then further adjourned

New Joint-Stock Company.—A company has been registered, under the title of the Tourtel Gas and General Engineering Company, Limited, with a capital of £3000 in £1 shares.

THE WATER-WORKS QUESTION AT PORTSMOUTH.

The Proposal to Purchase to be Re-considered.

This question was revived at a recent meeting of the Portsmouth Town Council by Alderman T. Scott-Foster, who invited the members to affirm the principle of placing the water supply of the borough in the hands of the local authority, and moved that a Committee be instructed to consider and report as to the best means of acquiring the works. The Alderman, in support of his motion, stated that he was induced to place the matter on the *agenda* again on account of the course of events in London and other large towns. It was true that as late as last year the Council rejected a recommendation of the Committee who had charge of the subject; but he hoped to show sufficient justification for bringing it forward again. It had occurred to him (and doubtless to other members also) that the only two ways open to the Corporation of purchasing the water-works were by agreement with the Company or by arbitration. If an Act of Parliament could be promoted with the assent of the Company, the costs in that direction would be very small. He was sure the members were all agreed that it was undesirable that a private Company should hold a monopoly, together with the right of entering upon the public roads and tearing them up at their pleasure. He asserted that a few years ago the water-works could have been purchased for a comparatively small sum; and since he had been a member of the Corporation, the undertaking might have been acquired at a cost of only £600,000. The value of the property, however, had so much increased that now they must make up their minds to pay something like a million for it—indeed, the longer the Council deferred the purchase, the more they would be required to pay. The growth of the income of the Company was simply due to the increase in the rateable value of the borough; and the rateable value would continue to rise considerably. If the purchase-money could be borrowed for 100 years, they could at once realize a profit on the working; while even if the repayments and interest extended over 80 years only, they would be almost able to hold their own from the beginning. As Parliament seemed to be anxious to assist local authorities to acquire water-works, he did not think they would experience the slightest difficulty in obtaining permission to borrow the requisite amount for 100 years. If the Council obtained control over the water supply, they would have to take off many of the vexatious charges now imposed; but that would be a matter for the consideration of the Committee. In the event of negotiations proving satisfactory, they would be able to obtain the property on reasonable terms; and the claims of the shareholders could be met by the issue of scrip bearing the same rate of interest as that now being drawn from the Company. Mr. Blessley seconded the motion. In reply to Mr. Brewis, Alderman Scott-Foster said that, if they could get 100 years in which to repay the loan, they would from the first make a profit of from £1000 to £2000 a year. Alderman Marvin did not think they would be able to get a period of 100 years for the repayment of the purchase-money; and upon this the success of the scheme depended. Then there were certain charges—termed vexatious charges—made by the Company which, if reduced, as they must be by the Corporation, would lessen the income very considerably. No provision appeared to have been made for compensation to Directors for the loss of their fees. A great deal, he added, had been said in the papers about the large statutory dividend paid to the shareholders; but they only received a little more than 3 per cent. on what they gave for their shares. The discussion ended in the motion being adopted; and a Special Committee was appointed to consider the question.

The written reply which the Secretary of the Company (Mr. R. W. Ford) made to the several questions as to the charges for water which were raised at an interview of a deputation of the Corporation Improvement Committee with his Directors (*ante*, p. 804), has induced Alderman Scott-Foster to publish the views of the Committee, although, as he points out, he has no authority to write in their name. The letter is too long to notice fully; but briefly his contentions are: (1) That many of the charges are vexatious and cannot in equity be defended, and that people are, in many respects, charged twice over. (2) Charges have been, and doubtless still are, illegally made, even according to the Company's Act. (3) Many charges, as compared with those of other companies, are much too high. (4) Arbitrary conditions are made. (5) The water is not always so satisfactory as to cleanliness as could be wished, and, incidentally, it could with advantage be much softer.

Exhibition of Gas Appliances.—An exhibition of the gas-stoves and other domestic appliances manufactured by Messrs. John Wright and Co., of London and Birmingham, was held last week at Barnard Castle. It was formally opened on Tuesday by the Chairman of the local Gas Company (Mr. J. H. Dawson).

The Oil-Gas Experiments at Bradford.—The experiments in oil-gas enrichment which have been going on for some time at the Bradford Corporation Gas-Works again claimed the attention of the Gas and Electricity Committee at their meeting last Friday. Dr. Dvorkovitz and the Gas Engineer (Mr. W. Wood) attended before the Committee to give information on the subject. The statements made are said to have been very conflicting. After a long discussion, it was resolved to call in an expert to report upon the whole question of the results obtained by means of various processes; and a Sub-Committee was appointed to carry out the resolution.

The Profits of the Leeds Corporation Gas Undertaking.—A statement was submitted at last week's meeting of the Leeds Corporation Gas Committee, showing that during the year 1894 there had been a profit on the gas-works of about £36,000. When the accounts are made up for the financial year, which ended on March 25, even a greater profit, it is expected, will be disclosed. The surplus will not only enable the Committee to pay off a debt of £31,000, but leave them with a small sum in hand. To the cheapness of coal, compared with the year 1893, the Committee chiefly attribute their present satisfactory position. It may be remembered that, by the abolition of meter-rents, a source of income that amounted to something like £11,000 has been sacrificed by the Committee.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

The Edinburgh and Leith Gas Commissioners held a solemn conclave on Tuesday of this week with Mr. Mackenzie, the Convener of the Corporation Electric Lighting Committee, upon the subject of explosions in street culverts, and how to prevent them. The conference was a most friendly one, which was highly creditable to both parties. Lord Provost M'Donald was responsible for it being held; Mr. Mackenzie having attended the meeting of the Commissioners on his invitation. They had, his Lordship said, all one object in view—that both methods of lighting might be a success, but above all that they should be absolutely safe, and that nothing should take place which would cause injury to life or limb. Mr. Mackenzie brought out the fact, which was new to me, that there had been a second explosion in an electric light culvert in Edinburgh. The one on the Castle Hill was known; but the other, which took place in Frederick Street about three weeks ago, was not. Arising out of it, Mr. Mackenzie's request was that the searching for leaks in gas-pipes by means of naked lights should cease. This was quite a reasonable request; and the same remark may be applied to his observation that he was aware that many leaks had been caused in gas mains and services by the operations of the Electric Lighting Committee. This was due, not to carelessness in their work, but to the extensive nature of their operations. He was anxious that explosions should be averted, on account not only of the danger to the public which lay in them, but also because of the danger of short-circuiting being caused by, for instance, a manhole cover coming down with force upon the mains. Bailie Kinloch Anderson, who voiced the opinions of the Gas Commissioners, gave Mr. Mackenzie the assurance that they would co-operate with his Committee. The Engineers of the Commission, he said, had given instructions that leaks were not to be searched for with naked lights near electric light mains; but in the Frederick Street instance this order had been neglected. Fresh instructions would, however, be issued. He threw out the suggestion that something might be done by the Electric Lighting Committee, by ventilating the culverts—up the lamp-pillars or otherwise—to prevent gas from accumulating in the culverts. To this Mr. Mackenzie replied that they were obliged to work under the Board of Trade; and that according to Major Cardew, ventilating the culverts was not so good a preventative of gas accumulating as the plugging of the culverts between the manholes, and the filling of the manholes as far as possible with a non-combustible material. They were, he said, doing this in Edinburgh; and his Engineer had informed him that he found less gas in the culverts in consequence. So the nice little conference ended. If it accomplishes no more than the establishment of good feeling, it will have served a useful purpose.

The Commissioners, acting upon the recommendation of the Works Committee, accepted tenders by Sir William Arrol and Co., Limited, to furnish and fit up mechanical stoking plant on the Arrol-Foulis principle in the Edinburgh Gas-Works, at a cost of £6470 5s., and to supply two boilers at a cost of £800. The work, Bailie Kinloch Anderson said, is to be completed by Sept. 1, so as to get it into operation before they begin to take on their winter hands; and in this way, they trusted very few of their men would be displaced. Mr. Mitchell's own men are to do all the local work in the fitting up of the plant.

The usual crop of suggestions, which are offered on the easy terms of "free, gratis, and for nothing," through the columns of the newspapers, has followed the turning on of the electric light in Edinburgh. Some of these are very foolish; but there have been one or two letters on the subject of the employment of gas-engines to generate electricity, originated by Mr. Brown, of Messrs. King, Brown, and Co., Rosebank Iron-Works, Edinburgh. Mr. Brown pointed out that in his works gas is superseding steam for power purposes; and they have no difficulty in getting the larger sizes of gas-engines to work satisfactorily. They have a gas-producing plant which was laid down according to plans prepared by Mr. W. Young, of Peebles; and Mr Brown went the length of asserting that the return from secondary products is about equal to the cost of coal, so that they get the gas power at an exceedingly cheap rate. This view has not given satisfaction to those who know nothing about the subject; but Mr. Brown has held to his point, and has practically silenced the sceptical writers. Of course, Mr. Brown's recommendation was that gas-engines would have been cheaper than steam-engines for the Edinburgh Corporation to have used in their electric lighting works; and his notion seemed to be that they should manufacture the gas for themselves. Now it will be remembered that Professor Kennedy was very anxious to use gas-engines to drive the dynamos; but his proposal was to obtain a supply from the Gas Commissioners. Had it not been for the refusal of the Commissioners to grant an abatement upon the price, it is most probable that gas-engines would have been adopted. Mr. Brown's idea of the electric lighting department themselves manufacturing gas, and then using it to drive engines, is not new—in fact, at Coatbridge this is being done, though not, I learn, with the best results. There is something to be said on both sides of the question; but probably the heaviest consideration is against the proposal, as it would make the Electric Lighting Committee undertake the double risk, connected with the sale of electric current, of becoming manufacturers of a substance which they could easily procure otherwise.

The Falkirk Gas Commissioners have now let the contracts for the introduction of the Peebles oil-gas process and Hislop's regenerative furnaces into their works. A sum of £2783, constituting the cost of the parliamentary and arbitration proceedings preceding the transfer, has been asked from the Commissioners by the Police Commissioners, which the Gas Commissioners are making arrangements to pay. They are also considering a proposal for the construction of a railway siding into the works; but as the line would pass through the property of the Falkirk Iron Company, they are obliged to get their consent in the first place. It is estimated that a saving of £100 a year would be effected by the railway connection.

The Scotch oil-masters have this week resolved to advance the price of burning oil a further 2d. per gallon—making a rise of 3d. per gallon within a month. This is an increase of almost 50 per cent., and will

seriously affect the use of oil for gas-making purposes. It should still, however, be profitable to use it.

In the Greenock Police Board this week, that inveterate critic of the Gas Committee, Bailie Dr. Cluchie, took exception to the cost of the banquet which was recently held to celebrate the introduction of the Peebles oil-gas plant to the works. There were some strong expressions, as is usual when Bailie Cluchie is "showing up" anything. But he was not successful in ascertaining the cost of the banquet; and the subject dropped without anything being effected.

At a meeting of the Forfar Gas Corporation this week the offers for the repair and enlargement of the purifiers at the gas-works were opened and considered. The lowest tender was by Messrs. Balfour and Co., of Leven, who offered to enlarge the purifiers for £415. The same firm offered to supply three new purifiers, of the same area as the old ones when enlarged, for £560. The other tenders were considerably higher. The Gas Manager (Mr. Waddell) said he thought the reason why the offers of the firms were so high, was that they were unwilling to risk taking down the old purifiers. He thought that if they were to buy the plates, with their own labour he could erect three new purifiers at a cost of about £550. In his report, he had estimated that four new large purifiers would cost £1000. Mr. Craik said the Corporation had to choose between £415 to repair the old purifiers, or £560 for new ones. The Provost said he understood that in the larger purifiers the Manager would be able to use cheaper coal. Mr. Waddell said they could use an inferior quality of coal. Mr. Christie remarked that he thought it was a misfortune so few of the members knew anything about the purifiers. It was strange that there should be so much difference between Mr. Wilson's estimate of £250 and the offers; and the only conclusion he could draw was that the Manager had asked the firms to estimate for more than Mr. Wilson thought was actually necessary. Bailie Milne moved that three new purifiers be erected, and that it be remitted to the Committee to arrange for the work being carried out. This was agreed to; two members dissenting.

The subject of the removal of the Rothesay Corporation Gas-Works from a confined site in the centre of the town to one outside, lately came before the Council in a more practical form than it has hitherto assumed. A Committee reported that they had obtained an offer from a local firm to sell Broadcroft Mills to the Commissioners for £2500; and they recommended the acceptance of the offer. They also submitted a report which they had procured from Mr. A. Gillespie, of Glasgow, upon the condition of the gas-works, and the proposal to transfer them. Mr. Gillespie recommended the introduction of a regenerative system of firing, which would, he said, raise the output of gas from 22,000 to 45,000 cubic feet per day, and would leave three-fourths, instead of one-half, of the coke for sale. The system, however, could not well be adopted on the present site, as the proximity to the sea and to the mill lade would make it difficult and costly to go down the necessary depth; and, besides, the walls of the retort-house were too low, and the space too confined, to allow the alterations to be made, keeping up the supply of gas at the same time. There was also no room for extending the purifying plant and storage, which was necessary in view of the increasing consumption. He had therefore come to the conclusion that no further expense should be incurred upon the existing works; and that to make use, on another site, of such portions of the plant as were suitable, was the best course. He approved of the Broadcroft Mills site, and submitted two plans—one showing an entirely new gas-works upon it, and the other showing how the existing buildings on the site might be altered so as to be made available for gas-making purposes. The Committee adopted the latter recommendation, along with Mr. Gillespie's estimate of £11,400 for the alterations and new works. In speaking to the reports, the Treasurer (Mr. Fisher) said that, beyond the above-named sum, £400 would be required for laying a main from the gas-works, and the purchase price of the new site had to be added, as well as the existing debt on the present works amounting to £5800, which would bring the total of their indebtedness up to £20,100; and as there would be legal expenses, the Committee estimated that about £21,000 would be required. From this, however, they deducted £1000, which they might receive for the present site and for part of the plant; leaving £20,000 as the amount they would have to provide. They were advised, he said, to adopt the Burghs Gas Supply (Scotland) Acts, under which they would be required to pay back every year one-fortieth of the principal sum borrowed; and therefore the annual charge against the Corporation would be, taking principal and interest into account, £1100. During the past five years, they had had an annual profit of about £1698, out of which they had paid yearly, on an average, £838 for depreciation and interest. They would have this £838 available to meet the charge upon the new works; and they expected a profit of £200 a year from the manufacture of sulphate of ammonia. They would also have the proceeds of the extra coke sold, and 1000 cubic feet of gas more per ton of coal; from all of which he calculated that they would have at their disposal a margin of £388 a year profit. He thought they could undertake the scheme with safety; and he moved its adoption. Mr. Burness considered that £25,000 would be nearer the cost of the new works than £21,000; and he said he believed they might have obtained a site for less money. He therefore moved delay. The Provost said he was sure no one had any desire to "rush" the matter; their wish rather was that they should carry it through with perfect unanimity—everyone recognizing that it would be the best thing for the burgh. It was accordingly resolved to hold a special meeting of the Council to discuss the subject.

Fylde Water-Works Company.—The half-yearly report of the Fylde Water Company states that during the past six months the capital account has been increased by £880, and now amounts to £359,388. Water and other receipts amounted to £15,496; and £350 is allowed for empty houses and bad debts. Interest on loans, working expenses, &c., absorb £4202; leaving a disposable balance of £10,942. Dividends of 4 per cent. on the preference stock, and 10 and 7 per cent. on the "A" and "B" stocks are proposed; carrying forward a balance of £1760. The Directors deplore the loss of Mr. Edmund Birley, their late Chairman, whose association with the Company as a Director dates from its formation.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *April* 20.

Sulphate of Ammonia.—Although the volume of business this week at some of the ports has been greater, it is principally owing to the fact that makers who have been so long waiting patiently have accepted such prices as buyers have been willing to offer. These prices have, however, been on a declining scale; but as the month draws to a close, there may still be some purchasing by dealers to cover sales. After this month, the production will perceptibly decrease, whereby makers will find considerable relief. That the spring trade has so far proved of a disappointing nature is seen by the shipments, which continue to show a gradual decrease, as against last year. Whereas the market opened at £10 2s. 6d. to £10 5s., the week closes very quietly; and the quotations are now £10. Nitrate of soda is dull; and the spot value is 8s. 4½d. per cwt.

LONDON, *April* 20.

Tar Products.—With the exception of carbolic acid and pitch (both of which are steady at the prices mentioned below), this market is distinctly flat. Benzols continue dull; while solvent naphtha, which in previous years was in good request at this time, is also difficult to sell. There is a plethora of tar oils of all descriptions; but whether the enormously improved price of petroleum products will reflect itself in the value of these common oils, it is not easy to forecast, as it is difficult to see the connection between the two, though the impression that it will do so is pretty general in the tar trade. Naphthalene and creosote salts are being more generally extracted from creosote; and although the price is wretched, an increasing business in them is apparently being done. Anthracene is dull, with little or no inquiry. Prices are as follows: Tar, 18s. to 21s. Pitch, 32s. 6d. to 34s. Benzol, 90's, 1s. 0½d.; 50's, 1s. Solvent naphtha, 1s. Toluol, 1s. 1½d. Crude, 30 per cent., naphtha, 4½d. Creosote, liquid, 1½d.; ordinary, 1d.; salts, 20s. Cresylic acid, white, 1s.; brown, 10d. Carbolic acid, 60's, 1s. 5½d. Anthracene, "A," 1s. 1d.; "B," 10d.

Sulphate of Ammonia.—There is no change, at any rate for the better, in this product, notwithstanding fairly active inquiry for home consumption. Buyers for foreign delivery hold aloof, and speak of still lower prices than are now being quoted. This market appears to be entirely in the hands of "bear" dealers; and, unfortunately, the anxiety of some manufacturers to sell assists the nefarious operations of such speculators. There are buyers, who evidently have orders up their sleeves, who have the conscience to offer £9 10s. What little business has been done during the week has been at prices ranging between £9 15s. and £10 in all positions, less 3½ per cent. Gas liquor is quoted at 7s. to 8s.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—A very depressed tone continues throughout the coal trade of this district; and it is becoming more and more evident that the large contracts, either for gas coal or locomotive fuel, which are placed during the ensuing season, will have to be taken at exceptionally low figures. The most serious difficulty which the Lancashire coalowners have to face is that, whilst they are bound for the next twelve months by the agreement with regard to wages made with the Miners' Federation, in other districts which are not under the Miners' Federation, reductions are gradually taking place, which will enable coalowners in the North to compete still more keenly with colliery proprietors in this district. The tenders for gas coal to which I referred last week, and which are coming upon the market much earlier than usual, have brought forward even lower quotations than those which I mentioned. Screened Wigan Arley four-feet gas coal has been offered at 6s. 6d. per ton at the pit; and partially screened Wigan Arley, at from 7s. to 7s. 6d. Of course, these represent specially low figures; some of the colliery owners not being prepared to tender on such a basis as this. But they are indications of the probable tendency of the market when further contracts come forward. With regard to other descriptions of round coal, the position remains much as reported last week; the demand being dull, with supplies plentiful. Prices are wanting in firmness. Although it is only in exceptional cases where actually reduced quotations are put forward, for best Wigan Arley 10s. to 10s. 6d. per ton at the pit is now about the full average price; for Pemberton four-feet and seconds Arley, 8s. 6d. to 9s.; with common round coals ranging, according to quality, from 6s. and 6s. 6d. up to 7s. and 7s. 6d. For shipping, the demand is also extremely quiet, with a very unsatisfactory outlook; and 7s. 6d. to 8s. per ton, delivered at the Garston Docks or the High Level, Liverpool, is about the average price for ordinary steam coal. The present small production of slack generally meets with a ready sale; and prices are about steady at recent quotations, ranging from 3s. 6d. and 4s. per ton for common, to 4s. 6d. and 5s. for better qualities.

Northern Coal Trade.—The coal trade of this district has now become very irregular. The demand for gas and household coals is diminishing; while the opening of the northern ports on the Continent is now enlarging the shipments. The prices of coals are thus unequally affected; steam qualities being firmer, and gas and household sorts lower, while the condition of the local Sales Association has its effect on the gas coal trade. Best Northumbrian steam coals are generally quoted at 8s. 9d. per ton f.o.b., though there are collieries asking more and some taking less than that price. Steam smalls, being scarce, are comparatively high; and 4s. per ton f.o.b. is the general quotation. In regard to gas coals, the price is very irregular; but 6s. 6d. to 6s. 9d. per ton f.o.b. may be taken as the general quotation. Contracts continue to be made at lower prices; but the supplies for the largest companies are not yet decided on, though it seems to be expected that the rate will be somewhere near 6s. 6d. per ton f.o.b., or the equivalent. Until near the end of the half year, there is not likely to be a settlement of all these contracts. Manufacturing coal is steady; and there appears to be an increasing demand. Coke is in fair request; and the prospects of the iron trade seem a little better. The furnaces in the north-west include one or two more that were idle for some months; though the exports

are still only moderate in amount. The price of best Durham coke may be given as from 12s. 6d. to 13s. per ton f.o.b., and at corresponding rates for the local blast furnaces. Gas coke is steady, the prices being unaltered; and as the production is now much lower, the shipments and the home consumption keep the stocks low. It is expected that the wages question in the Durham coal trade will be speedily decided by the Umpire.

Scotch Coal Trade.—There is still much depression in the Scotch coal trade, and little prospect of improvement, except that it is now virtually settled that the miners will accept the reduction of 6d. per day. There is great quietness prevailing; and prices are a shade easier. The quotations are: Main, 6s. per ton f.o.b. Glasgow; ell, 7s.; splint, 6s. 6d. to 6s. 9d.; and steam, 7s. 6d. to 7s. 9d. The shipments for the week amounted to 141,696 tons—an increase on the previous week of 3735 tons, and on the corresponding week of last year of 5753 tons. For the year to date, the total shipments have amounted to 1,610,857 tons—a decrease upon the quantity in the corresponding period of last year of 362,712 tons.

Removal.—With the view of obtaining additional accommodation for meeting the requirements of their business, Messrs. George Bray and Co. have concentrated their three works in extensive premises situated in Leicester Place, Blackman Lane, Leeds.

Milton and Sittingbourne Water Supply.—A dispute having arisen between the Urban District Councils of Milton and Sittingbourne as to the supply of water, the matter has been referredto Major Tull och, who will shortly hold an inquiry in regard thereto. The Milton District Council claim that they are entitled to one-third of the gross receipts, in accordance with an award made by Major Tulloch eleven years ago; but the Sittingbourne authorities contend that there are to be certain exemptions.

The Water Supply of Dorking.—The inhabitants of Dorking, like the residents in most other towns, suffered inconvenience in respect of their water supply during the late frost; and in consequence they have held a public meeting to consider the "whole question" of the supply. Much discussion of a desultory character took place. It was wound up by the passing of one resolution agreeing to present a petition to the Board of Trade, complaining of the insufficient depths at which the Company's pipes were laid, and alleging that the cutting off of the water in the winter was an annual occurrence; and another, expressing the opinion that the time has arrived when the Council should consider the best means of supplying water to the town.

A Compliment to the Gravesend Gas Company.—It is not often that credit is given to a gas or water company for endeavouring, in circumstances of exceptional difficulty, to keep up the supply of their commodity; and therefore it is pleasant to record an instance where efforts of this kind have been duly recognized. At the last meeting of the Gravesend Town Council, Alderman Butchard remarked that there were members of the Corporation who were always ready to blame; but it was very seldom that praise was heard in their midst, He thought, however, the Gas Company and their Engineer (Mr. J. Davis) deserved some complimentary notice; for, notwithstanding the recent severe weather, the public lamps were lighted without interruption. The remark was followed by an approving "Hear, hear."

Kimberley Water-Works Company, Limited.—The annual general meeting of this Company was held last Wednesday week; Mr. A. J. Macdonald in the chair. In moving the adoption of the report, the Chairman expressed regret at having to state that the past year's work had produced the worst return since the first dividend was declared. Last year they paid 5 per cent.; this time they proposed to pay only 2 per cent., and even this with some slight squeezing of the contingency fund. The financial position of the Company, however, was sound; and, both at home and abroad, the strictest economy was practised. The total consumption of water in the past year was not very much more than half of that consumed during 1893. The entire bulk, however, was divided between the mines and the townships of Kimberley and Beaconsfield; and the falling off had taken place chiefly in connection with the former—the figures for 1893 and 1894 being practically the same for the towns. He concluded by expressing a hope that a turn in the fortunes of the Company might soon take place. Mr. J. Jackson, in seconding the motion, also regretted that the report and balance-sheet were of a disappointing character. He added, however, that the Directors had agreed to accept £1000 a year as their remuneration until a dividend of 5 per cent. or more should be paid. The motion was carried unanimously; and the proceedings closed with a vote of thanks to the Directors.

Alderman Gainsford on the Recent Water Supply Difficulties at Sheffield.—Alderman Gainsford made a long statement at a recent meeting of the Sheffield City Council respecting the interruption which occurred in the water supply during the last two months through the frost. The subject, he said, was one which would require very serious and careful consideration hereafter. They, as a Corporation having the control of the water undertaking, ought not to be satisfied with the works in such a condition as that, under any circumstances, there could be again an interference of this kind with the regular supply. In his opinion, the resources of civilization were equal to coping with a frost even of that severity; and it would be the duty of the Corporation to do all that was possible to prevent a recurrence of the conditions through which they were now passing. Even that day the quantity of water which was running down from the reservoirs, and which was being disposed of either usefully or otherwise, was almost double the normal quantity. According to the reports which he received every week, the amount supplied per day was 13,940,000 gallons; the normal supply being 7,500,000 gallons. At one time during February, the quantity distributed was 17,000,000 gallons per day; and the work which had been done in stopping leakages and waste had reduced it to just under 14,000,000 gallons. There was still, however, an enormous amount of work to be accomplished. The number of men now employed in repairing fractured service-pipes throughout the district was 200. In the course of a discussion on the question, it was suggested it might be possible to obtain the assistance of the Gas Company's pipe-layers, so as to expedite the work.

The Public Lighting of Oswestry.—At the last meeting of the Oswestry Town Council, the Watch and Estates Committee recommended that a new contract be entered into with the Gas Company, and that the following conditions be inserted: That the minimum lighting power of the gas supplied be 16 candles; that the minimum pressure be from half an hour before the time prescribed for the lighting of the lamps to 8 p.m. 25-10ths, from 8 p.m. to midnight 20-10ths, and during the remainder of the night and day 12-10ths; that all burners on the public lamps be 5-feet burners; and that a Sugg photometer and Thorp portable pressure-gauge be purchased by the Council, and clauses be inserted in the contract imposing penalties for any infraction of the agreement as are imposed under the Gas-Works Clauses Acts, and providing for arbitration in case of any dispute. On the report being introduced for discussion, the Mayor (Mr. G. Perks) said he disagreed with the first two paragraphs. He was not in favour of a 16-candle power gas, as the majority of towns used gas of only 15-candle power. He moved, as an amendment, that the illuminating power be 15 candles. A proposition having been made that the recommendation should stand, Mr. Mason said he did not think the members were aware that a deputation had waited on the Committee from the Gas Company; and they had before them a number of towns, only five or six of which were supplied with gas above 16-candle power, 40 or 50 with 15-candle gas, and about 300 with less. Mr. Williams stated that the Committee had held three meetings, after which they arrived at the conclusion that 16-candle gas would be best; and he should support their recommendation. He had submitted to the Committee a number of towns in which the cost ranged from 2s. to 2s. 10d.; and the quality of gas in some instances was 17, 18, and 19 candles. If those towns could supply rich gas at the price named, they were not unreasonable in asking the Oswestry Gas Company to give them 16-candle gas at 3s. 11d. per 1000 cubic feet. On a division, eight members voted in favour of the illuminating power being 16 candles, and six against. With reference to the recommendation as to pressure, it was agreed that the condition should be altered to 20-10ths from the time of lighting up to midnight, and 12-10ths during the remainder of the night and day. The other recommendations were adopted.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

(For Stock Market Intelligence, see ante, p. 839.)

Issue.	Share	When ex-Dividend.	Dividend & Bonus.	NAME	Paid per Share	Closing Prices	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.	GAS COMPANIES.				£ s. d.
590,000	10	10 Apl.	10½	Alliance & Dublin 10 p. c.	10	21–22*	..	4 15 5
100,000	10	,,	7½	Do. 7 p. c.	10	14–15*	..	5 0 0
300,000	100	2 Jan.	5	Australian (Sydney) 5 % Deb.	100	105–107	..	4 13 4
200,000	5	14 Nov.	6½	Bombay, Limited	5	6½–7	..	4 12 10
40,000	5	,,	6½	Do. New	4	4½–5¼	..	4 19 2
380,000	Stck.	28 Feb.	11½	Brentford Consolidated	100	243–248	..	4 12 8
180,000	,,	,,	8½	Do. New	100	195–200	..	4 5 0
220,000	Stck.	14 Mar.	11	Brighton & Hove Original	100	220–225	..	4 17 9
888,500	Stck.	28 Feb.	5	Bristol	100	119–122	–1	4 1 11
320,000	20	28 Mar.	11½	British	20	50–51	..	4 8 2
50,000	10	14 Mar.	11½	Bromley, Ordinary 10 p. c.	10	21–22	..	5 4 7
51,510	10	,,	8½	Do. 7 p. c.	10	16–17	..	5 0 0
328,750	10	14 Nov.	2	Buenos Ayres (New) Limited	10	6¼–6¾	..	2 19 3
200,000	100	2 Jan.	6	Do. 6 p. c. Deb.	100	100–103	..	5 16 7
150,000	20	28 Feb.	8½	Cagliari, Limited	20	26½–27½	..	6 0 0
550,000	Stck.	10 Apl.	13½	Commercial, Old Stock	100	283–288*	..	4 13 9
165,000	,,	,,	10½	Do. New d o.	100	212–217*	..	4 16 9
160,762	,,	13 Dec.	4½	Do. 4½ p. c. Deb. do.	100	130–135	..	3 6 8
800,000	Stck.	13 Dec.	13	Continental Union, Limited.	100	247–252	..	5 3 2
200,000	,,	,,	10	Do. 7 p. c. Pref.	100	205–210	..	4 15 3
535,000	Stck.	28 Feb.	5½	Crystal Palace Ord. 5 p. c. Stk	100	118–123	..	4 5 4
486,090	10	31 Jan.	11	European, Limited	10	24–25	..	4 8 0
354,060	10	,,	11	Do. Partly paid	7½	17–18	..	4 11 9
5,646,590	Stck.	14 Feb.	12	Gaslight & Coke, A, Ordinary	100	265–270	–2	4 8 11
100,000	,,	,,	4	Do. B, 4 p. c. max.	100	105–110	..	3 12 9
665,000	,,	,,	10	Do. C, D, & E, 10 p.c.Pf.	100	275–280	..	3 11 5
30,000	,,	,,	5	Do. F, 5 p. c. Prf.	100	130–135	..	3 14 1
60,000	,,	,,	7½	Do. G, 7½ p. c. do.	100	197–202	..	3 14 3
1,300,000	,,	,,	7	Do. H, 7 p. c. max.	100	183–188	..	3 14 6
463,000	,,	,,	10	Do. J, 10 p. c. Prf.	100	275–280	..	3 11 5
476,000	,,	,,	6	Do. K, 6 p. c. Prf..	100	163–168	..	3 11 5
1,061,150	,,	13 Dec.	4	Do. 4 p. c. Deb. Stk.	100	129–132	†1	3 0 7
294,850	,,	,,	4½	Do. 4½ p. c. do.	100	140–145	..	3 2 1
908,000	,,	,,	6	Do. 6 p. c. do.	100	188–192	..	3 2 6
3,800,000	Stck.	14 Nov.	12	Imperial Continental	100	240–245	–1½	4 18 0
75,000	5	13 Dec.	6	Malta & Mediterranean, Ltd.	5	5¾–6¼	..	4 16 0
560,000	100	1 Apl.	5	Met.of Melbourne, 5 p.c. Deb.	100	109–111	..	4 10 1
541,920	20	14 Nov.	5	Monte Video, Limited	20	15¾–16¼	..	6 1 2
150,000	5	29 Nov.	8	Oriental, Limited	5	7–7½	..	5 6 8
60,000	5	28 Mar.	7	Ottoman, Limited	5	4¾–5¼	+¼	6 13 4
166,870	10	14 Feb.	2	Para, Limited	10	1½–2½	..	8 0 0
				People's Gas of Chicago—				
420,000	100	2 Nov.	6	1st Mtg. Bds.	100	105–109	..	5 10 1
500,000	100	1 Dec.	6	2nd Do.	100	102–107	..	5 12 1
150,000	10	11 Oct.	7†	San Paulo, Limited	10	9–10	..	7 0 0
500,000	Stck.	14 Feb.	15½	South Metropolitan, A Stock	100	350–360	..	4 6 1
1,350,000	,,	,,	12	Do. B do.	100	293–298	..	4 0 6
290,000	,,	,,	13	Do. C do.	100	305–310	..	4 3 10
775,000	,,	16 Jan.	5	Do. 5 p. c. Deb. Stk.	100	167–172	..	2 18 2
60,000	Stck.	28 Feb.	11½	Tottenham & Edm'nton, "A"	100	230–235	..	4 17 10
				WATER COMPANIES.				
746,021	Stck.	28 Dec.	10½	Chelsea, Ordinary	100	278–283	..	3 11 6
1,719,514	Stck.	10 Apl.	8	East London, Ordinary	100	215–220*	..	3 12 9
654,740	,,	28 Dec.	4½	Do. 4½ p. c. Deb. Stk.	100	151–156	+4	2 17 8
700,000	50	13 Dec.	8½	Grand Junction	50	109–113	..	3 15 3
708,000	Stck.	14 Feb.	12	Kent	100	303–308	..	3 17 11
1,043,800	100	28 Dec.	9½	Lambeth, 10 p. c. max.	100	245–250	..	3 16 0
406,200	100	,,	7½	Do. 7½ p. c. max.	100	200–205	..	3 13 2
330,000	Stck.	28 Mar.	4	Do. 4 p. c. Deb. Stk.	100	136–140	+2	2 17 2
500,000	100	14 Feb.	12½	New River, New Shares	100	370–380	..	3 7 0
1,000,000	Stck.	31 Jan.	4	Do. 4 p.c. Deb. Stk.	100	140–143	..	2 15 11
902,300	Stck.	13 Dec.	6	S'thwk & V'xhall, 10 p.c. max.	100	148–153	..	3 18 5
126,500	100	,,	6	Do. D 7½ p.c. do.	100	140–145	..	4 2 9
1,155,066	Stck.	13 Dec.	10	West Middlesex	100	268–273	..	3 13 3

*Ex div.

† Next dividend will be at this rate.

The Mid-Kent Water Order.—The Board of Trade have informed the Aylesford and Eccles Local Authorities that they have, with some slight modifications, agreed to grant the Provisional Order applied for by the Mid-Kent Water Company, in regard to which an inquiry was held on the 19th ult. (see *ante*, p. 656). The most important alteration in the scheme is that the extension works are to be carried out in one year instead of in six years as proposed.

Bristol Water Company.—At the annual meeting of this Company on the 30th ult., the Chairman (Mr. E. Bush) informed the shareholders that during the past year there had been an increase of £1040 in the revenue from water-rates. This amount, he said, would have been very much larger had it not been for the exceptionally wet summer and autumn through which they had passed. The actual increase derived from water-rates amounted to £2307; but this was reduced by £564 less received for street watering, £126 less from the Sanitary Authority, and £577 less on the general trade—amounting in all to £1267. Regarding the other side of the account, he remarked that, notwithstanding the increased capital and the expansion of the works, the office and engineering expenses were but a trifle above those of the previous year; and the same applied to the collector's commission. A saving had been effected at Chelvey, where there had been less pumping owing to the wet season. This fact, together with the reduced price of coal, made a difference of £2847; the figures being £1939 against £4786. Expenses at the other pumping-stations had also been less. A saving of between £500 and £600 had been effected in rates and taxes. The net saving of £3602 that had been made, it was proposed to carry forward; and it was hoped their saving would be considerably augmented. The idea was to form a reserve fund to bear the outlay on the Yeo Valley works—which were going on slowly, but surely—when they were finished. Another satisfactory feature worthy of remark was that the working expenses were 27 per cent., against 30 per cent. last year. Respecting the Bill for granting further powers to the Company, he said it had passed the House of Lords, and was now in the Commons. As to the weather recently, it had been unprecedented in severity, such as they had not experienced since the Company was formed—now nearly fifty years ago. The officials and staff had done their best to minimize the difficulty. About 130 extra men had been engaged and trained, and 18 water-carts had been employed; and, as a result, he did not think many people had been absolutely without water. The report was adopted.

The Finances of the Huddersfield Corporation Water Department.—Alderman Crosland reported at last Wednesday's meeting of the Huddersfield Town Council that the income from water supplied last year for manufacturing purposes was £2000 less than the year before; there had been £640 less owing to empty property and reduced valuations; £250 had been spent on repairs of burst mains through the frost; and £550 paid for the distribution of water during the frost. These were matters that they could not estimate for at all. The receipts were £3440 less than the estimate; and still they had handed £800 towards the rates.

The Proposed Purchase of the Fylde Water-Works by Local Authorities.—A further conference of the various bodies who are formulating a scheme for the purchase of the Fylde Water-Works undertaking has lately been held at Blackpool. All the authorities in the area of supply were represented, and the decision to purchase was reaffirmed. It was resolved to appoint an engineer and auditor to go thoroughly into the details of the undertaking. When a scheme has been drawn up, based upon the reports of these experts, the ratepayers in each district will be consulted as to whether or not the purchase is to be concluded. The idea is to have a Joint Board representative of each authority according to rateable value; but not so that two combined could outvote the remainder upon any question that might be brought forward.

The Price of Gas at Barnsley.—At the meeting of the Barnsley Town Council last Wednesday, the minutes submitted by the Park and Lighting Committee recommended the Council to respectfully suggest to the Gas Company that the price charged to the public for gas should now be reduced to 3s. per 1000 cubic feet; the present cost of coal being much less than when the charge for gas was raised, in 1889, from 3s. to 3s. 4d. In moving the adoption of the minutes, Alderman Wray said the Committee thought it was time the public had more consideration from the Company. They believed, rightly or wrongly, that the consumers were under a very great injustice in this direction. They were thoroughly convinced in this respect; and it could not be gainsaid that they were paying above 30 per cent. more than in other towns similarly situated in a coal district. He believed the price of gas coal was much lower than it had been for some time; while the market was very well stocked. The minutes were adopted.

GWYNNE & BEALE'S
PATENT GAS EXHAUSTERS AND ENGINES.

Telegrams: "GWYNNEGRAM, LONDON." Telephone No. 2698.

GWYNNE & CO.,

HYDRAULIC AND GAS ENGINEERS,

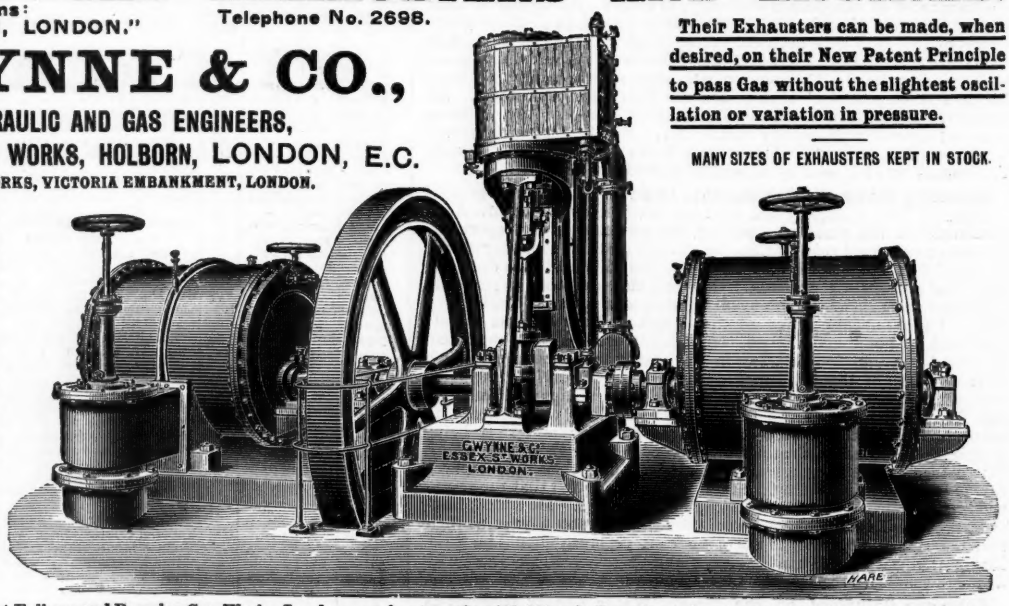
BROOKE STREET WORKS, HOLBORN, LONDON, E.C.

Late ESSEX STREET WORKS, VICTORIA EMBANKMENT, LONDON.

They have completed Exhausters to the extent of 32,000,000 cubic feet passed per hour, which are giving unqualified satisfaction in work.

Makers of GAS-VALVES, HYDRAULIC REGULATORS, VACUUM GOVERNORS, PATENT RETORT-LIDS, STEAM PUMPS for Tar, Liquor, or Water; CENTRIFUGAL PUMPS and PUMPING ENGINES, specially adapted for Water-Works, raising Sewage, &c.

Also GIRARD and other TURBINES, HIGH SPEED ENGINES, DYNAMOS, &c., &c., for ELECTRIC LIGHTING.



Their Exhausters can be made, when desired, on their New Patent Principle to pass Gas without the slightest oscillation or variation in pressure.

MANY SIZES OF EXHAUSTERS KEPT IN STOCK.

Exhausting Machinery at Fulham and Bromley Gas-Works, London—each set passing 400,000 cub. ft. per hour drawing 14 miles distant from Beckton.

Catalogues and Testimonials sent on application.

GAS PURIFICATION AND CHEMICAL COMPANY' LIMITED.

OXIDE OF IRON.

O'NEILL'S Oxide has a larger annual sale in the United Kingdom than all other Oxides combined. Purity and uniformity of quality guaranteed. Pamphlet, "How to Purchase Bog Ore," to be obtained on application.

JOHN WM. O'NEILL, Managing Director,
Palmerston Buildings, Old Broad Street, London, E.C.

ANDREW STEPHENSON, AGENT. All communications *re* Oxide to be addressed to Palmerston Buildings.

WINKELMANN'S "VOLCANIC" CEMENT. Fire Resistance up to 4500° Fahr. In use in most Continental Gas-Works, and in more than 900 British Gas-Works.

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182, GRESHAM HOUSE,
OLD BROAD STREET,
LONDON, E.C.
Telegrams: "Volcanism, London."

W. C. HOLMES & CO., Huddersfield; AND 80, CANNON STREET, LONDON,
Contractors for Gas-Works complete, Makers of Gasholders, Purifiers, Scrubbers, Condensers, Retort Fittings, &c., Improved Valves, Engines, and Exhausters. Also Improved Patent Rotary Scrubber-Washers.
*** See Advertisement p. II., centre of JOURNAL.
Cablegrams: "Ignitor London." Telegrams: "Holmes Huddersfield."

J. & J. BRADDOCK, Globe Meter Works, Oldham.
First-Class Award, Melbourne Exhibition, 1889, for WET AND DRY GAS-METERS, STATION METERS, AND GOVERNORS, PRESSURE-GAUGES, STREET LAMPS AND PILLARS, &c.
Telegraphic Address: "Braddock Oldham."

SULPHURIC ACID.

JOHN NICHOLSON & SONS, Limited; Chemical Works, Leeds, specially produce this ACID from BRIMSTONE, for making SULPHATE OF AMMONIA of high quality and *good* colour. Delivery in our own Railway Tank-Wagons or Carboys. Highest references and all particulars supplied on application.

GAS PURIFICATION.

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BALE & CO.'S Oxide of uniform quality Sample and Price on application.
OXIDE PAINTS, OILS, SULPHURIC ACID, &c.
120 and 121, NEWGATE STREET, LONDON, E.C.
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OXIDE OF IRON.

FINEST Quality of Natural Bog Ore. Particulars and price, apply to Mr. T. L. ARCHER, 20, Fennel Street, MANCHESTER.

In Paper Covers, Post Free, Price 2s.

S. CARPENTER on the Purification of COAL GAS from CARBONIC ACID and the SULPHUR COMPOUNDS by LIME, OXIDE OF IRON, and ATMOSPHERIC AIR.
S. & H. W. CARPENTER, 3, Bedford Villas, Carshalton, SURREY.

NOTICE TO ADVERTISERS.—COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office *not later* than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or Stoppages of PERMANENT ADVERTISEMENTS, should be received not later than the FIRST POST on SATURDAY.

AMMONIACAL LIQUOR Wanted.
BROTHERTON AND CO., Ammonia Distillers.
Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

GAS TAR Wanted.
BROTHERTON AND CO., Tar Distillers.
Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

SPENT OXIDE Wanted.
BROTHERTON AND CO., Chemical Manufacturers.
Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

BROTHERTON & CO.
Offices: Commercial Buildings, LEEDS.
Correspondence invited.

GOLD MEDAL, 1893.

TUBES and Fittings for Gas, Steam, and Water, in stock to 8 inches diameter; Iron and Steel Ascension-Pipes.
JOHN SPENCER, Globe Tube Works, WEDNESBURY; and 14, Great St. Thomas Apostle, LONDON.

CHARTERING, FORWARDING, AND INSURANCE.

ROBERT BRUCE FITZMAURICE, 29, Great St. Helens, London, Shipping Agent to several Gas Companies and Plant Manufacturers, would be glad to UNDERTAKE LARGE or SMALL SHIPMENTS to any Port.

HUTCHINSON BROTHERS, Gas Engineers, &c., Falcon Works, Barnsley, Makers of Wet and Dry Gas-Meters, Brass-Work, and general Gas Apparatus, Lead Saturators, Tanks, &c., Tools, and Gas-Works Sundries. (See last week, p. 820.)
Telegrams: "HUTCHINSON BROS., BARNSLEY."

RETORT Setter requires permanency (Foreign preferred). Competent to prepare Plans on all known Principles, or to erect on Engineer's own Plans.
Address No. 2516, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a Situation as Main and SERVICE LAYER (Gas or Water). Thoroughly practical, with experience in the management of men. Good Testimonials.
Address No. 2515, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

PARTNERSHIP.

A GENTLEMAN, with Established and Profitable Business, would JOIN OR AMALGAMATE WITH ANOTHER FIRM having a profitable Business.
Address No. 2514, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

EXPERIENCED pushing Traveller, with Connection among Gas and Railway Companies' Engineers and leading Ironmongers, desires REPRESENTATION OF FIRM or would take up good SPECIALITY.
Address No. 2518, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

A YOUNG Married Man requires a Situation in Gas-Works as HANDY MAN. Thoroughly understands Main and Service Laying and Fixing Meters, or able to take charge of a Small Works. Good references.
Address ROBERT HOCKLEY, care of Mr. Banham, Gas-Works, Wymondham, NORFOLK.

A YOUNG Man (aged 28) wants Situa- tion as WORKING MANAGER or FOREMAN. Thoroughly understands the Manufacturing and Distributing of Gas, Mains and Services, Meter Fixing. Inspecting and Fitting in all its Branches, and can undertake House-Fitting, if required. Always resided on Company's Works.
Address No. 2512, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

AUSTRALIA OR NEW ZEALAND.

ADVERTISER, who, for the past 3½ years, has been successfully Manager and Secretary of a small Gas-Works in N.S.W., Australia, paying 8 per cent. in the face of floods and bad times, being desirous of a change, would take a position as ASSISTANT in large, or as SECRETARY and MANAGER in medium sized Works. Thorough practical Mechanic in all branches (Repairs a Speciality). Twenty years' practical experience as Mechanic, Meter Inspector, District Inspector, Manager and Secretary. Gained Certificate in Chemistry and Mechanical Drawing; also first class in Ordinary and second class in Honours Examination, City and Guilds of London Institute. Total abstainer; age 36; and married. Would act as Agent or Traveller for English Firm. Highest references as to moral character.
Address "RADIARY," G.P.O., SYDNEY, N.S.W.

G. J. EVESON wants a Representative, for Export and Inland Trade, who can sell Coal, Cannel, and Tubes in every locality where representative is not already appointed, either on Commission or Salary, or both, with adequate allowance for expenses.
Apply, by letter, to G. J. EVESON, Corporation Street, BIRMINGHAM.

SPECIAL PAINT FOR GAS-WORKS.

JOHN E. WILLIAMS AND CO.,
VICTORIA PAINT WORKS,
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Telegrams: "ENAMEL." National Telephone 1759.

GAS PLANT CEMENT.

JOHN E. WILLIAMS AND CO.,
VICTORIA PAINT WORKS,
MANCHESTER.
For all Joints in connection with Oil-Gas Plant and Sulphate Plant.
For all Gas Joints.
For all Tar Joints.
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AMMONIA SATURATORS.

WALTER THOMASON and SONS, Chemical Plumbers, &c., and Makers of Lead Saturators, &c., 21, WESTON STREET, BOLTON. Repairs of every description.
Please write for Estimate before ordering elsewhere.

PATENTS FOR INVENTIONS.

J. C. CHAPMAN, M.I.M.E. and Fel. Chartered Inst. Patent Agents. ADVICE ON ALL MATTERS CONNECTED WITH ABOVE.
Information and Handbook on application.
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SADLER AND CO., LIMITED, MIDDLESBROUGH; ULVERSTON (BARROW); PORTSMOUTH; CARLTON; STOCKTON; 315, St. Vincent Street, GLASGOW; and 85, Water Street, NEW YORK. Tar Distillers, Manufacturers of all TAR PRODUCTS, ALIZARINE and other TAR COLOURS, BICHROMES, OXALIC ACID, ALKALIES, LIQUOR AMMONIA, AMMONIA SULPHATE, &c.
Head Office: MIDDLESBROUGH. Correspondence invited.

£5 will be given to any person procuring Advertiser a Situation as METER INSPECTOR or CLERK. Four years' experience in large Gas Office.
Address No. 2510, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, for a small Gas-Works, a good STOKER, used to Shovel work, and to make himself generally useful.
Apply to the SECRETARY, Gas Company, Knighton, RADNORSHIRE.

ASSISTANT SECRETARY.

A PROVINCIAL Gas Company in the South of England require the services of a gentleman as ASSISTANT SECRETARY. He must possess energy, tact, and ability; be a good Accountant, and well versed in the Secretarial Duties of a Company's Office. Salary to commence at £250, rising by increments of £20 per annum to £350.
Applicants are requested to state Age, whether Married or Single, where Experience acquired, and present Employment.
Testimonials will not be required in the first instance; but applicants should give the names of those to whom they will be prepared to refer.
Apply, by letter, not later than the 6th of May next, to No. 2511, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, for a Village Gas-Works, a GASHOLDER, with Iron Tank; capacity from 5000 to 7000 cubic feet.
Address C. W. GRIMWOOD, Sudbury, SUFFOLK.

WANTED, a small Governor, 4-inch or 5-inch Connections.
Send lowest Price and Particulars to No. 2513, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

FOR SALE—Two second-hand Purifiers. Size, 10 ft. by 5 ft. by 3 ft. deep, inside measurements, with Covers and Wood Grids, by Dempster, of Elland, complete.
For further Particulars, apply to the SECRETARY, Gas-Works, BRECON.

GASHOLDER for Sale, 100 feet diameter. Suitable for Telescoping. It is in good condition; but the ground it now occupies is wanted for Extensions.
Apply, by letter, to No. 2517, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

MARKET HARBOROUGH GASLIGHT AND COKE COMPANY.

FOR SALE.

OWING to Alterations, the above Com- pany have the following FOR SALE, in good condition:—
Twelve 15-inch ROUND MOUTHPIECES.
Eight 14 in. by 14 in. ⌂-shaped MOUTHPIECES, with duplicate Lids and Cross Bars.
Length of HYDRAULIC MAIN for four Beds of five Retorts, with ASCENSION, BRIDGE, and DIP PIPES.
ASH-PANS, FURNACE DOORS, &c.
Further Particulars from, and offers to,
J. FRYER,
Manager.
April 20, 1895.

PORTER & CO., Gowts Bridge Works, LINCOLN, Engineers, Ironfounders, and Contractors for the erection of Gas-Works for, Towns, Villages, Mansions, Manufactories, Collieries, and Isolated Buildings, at home and abroad. Manufacturers of Retorts and Fittings, Condensers, Scrubbers, Purifiers, Valves, &c.; also of Girders, Wrought and Cast Iron Tanks, Iron Roofs, &c.
Telegraphic Address: "PORTER LINCOLN."

HYDRATED OXIDE OF IRON.

PREPARED from pure Iron.
Two or three times as rich as Bog Ore.
Strong action on Sulphuretted Hydrogen.
To be used alone, but will increase activity of other Oxides.
Less than half the price of Bog Ore.
Can be lent on hire.
Write for tabulated results.
READ HOLLIDAY AND SONS, LIMITED, HUDDERSFIELD.

PURIFIERS.

OFFERS wanted for four 12 ft. by 12 ft. by 4 ft. PURIFIERS, with Centre-Valve (now working); 10-inch connections. Erected new about Twelve years ago. To be replaced by larger ones.
Tenders to be sent in on or before the 2nd of May next, addressed to S. BARK, Manager, &c., Gas-Works, GODALMING.

THE URBAN DISTRICT COUNCIL OF ABERTILLERY.

FOR SALE.

THE above Council have for Sale at their Gas-Works—
(1) A GASHOLDER, 30 ft. by 10 ft.
(2) A SCRUBBER, 10 ft. by 3 ft.
(3) A STATION METER, 1200 cubic feet per hour capacity.
(4) A number of 6-inch VALVES and SPECIAL PIPES.

The above can be inspected on application to the Manager at the Gas-Works, Abertillery.
Tenders for same, endorsed "Tender for Gas Plant," should be sent to the undersigned on or before the 4th day of May next.
The Council does not bind itself to accept the highest or any tender.
Dated this 1st day of April, 1895,
By order,
JNO. ALEX. SHEPARD,
Clerk to the Council.
Town Hall, Tredegar, Mon.

TENDERS required for the supply of about 1200 tons of screened GAS COAL to the Metropolitan Railway Station at Rickmansworth, from June 30, 1895, to June 30, 1896, free from bass and all other impurities.
Name of Coal and Analysis to be given with tenders, which are to be sent in on or before May 10, 1895, to the Secretary, Rickmansworth Gas Company, Limited.
The Company do not pledge themselves to accept the lowest or any tender.

TIPTON GAS-WORKS.

THE Gas Committee of the Tipton Urban District Council invite TENDERS for the supply of FIRE-CLAY RETORTS, BRICKS, Patent REGENERATOR TILES, &c.
Specification and Form of Tender may be obtained at the Gas-Works, on application to Mr. Vincent Hughes, the Engineer and Manager.
Sealed and endorsed tenders to be sent to me the undersigned, not later than Ten a.m., on Monday, April 29 inst.
The Gas Committee do not bind themselves to accept the lowest or any tender.
By order,
GEO. M. WARING,
Clerk to the Council.
Public Offices, Tipton,
April 17, 1895.

BOROUGH OF BEVERLEY.

TENDERS FOR TAR.

THE Corporation of Beverley desire to receive TENDERS for the purchase of the surplus TAR made at the Beverley Gas-Works for One Year from and after the 1st of May next.
Further Particulars may be obtained from Mr. Gibson, the Manager at the Works.
Tenders, endorsed "Tender for Tar," must be delivered at my Office not later than Monday, the 29th inst.
The Corporation do not bind themselves to accept the highest or any tender.
By order,
J. WILLIS MILLS,
Town Clerk.
Guildhall, Beverley,
April 17, 1895.

BOROUGH OF BEVERLEY.

THE Corporation of Beverley desire to receive TENDERS for the supply of two WROUGHT-IRON LATTICE GIRDERS.
Particulars and Drawings may be obtained from Mr. Gibson, the Manager of the Gas-Works, Beverley.
Tenders, endorsed "Tender for Girders," must be delivered at my Office on or before the 29th inst.
The Corporation do not bind themselves to accept the lowest or any tender.
By order,
J. WILLIS MILLS,
Town Clerk.
Beverley, April 18, 1895.

THE Widnes Corporation invite Tenders for the supply of about 20,000 tons of GAS COAL (slack, "through and through," or screened Coal), for the period ending the 30th of June, 1896, to be delivered at the Gas-Works, Widnes.

Conditions and Forms of Tender may be obtained from Mr. Isaac Carr, Assoc.M.Inst.C.E., Gas Engineer, Widnes.

Tenders, endorsed "Gas Coal," to be delivered to the undersigned on or before the 4th of May prox.

The lowest or any tender not necessarily accepted.

H. S. OFFENHEIM,
Town Clerk.

Town Hall, Widnes,
April 11, 1895.

DUNFERMLINE GASLIGHT COMPANY, LIMITED.

TAR AND AMMONIACAL LIQUOR.

THE Directors of the above Company are prepared to receive OFFERS for the TAR and AMMONIACAL LIQUOR, to be produced in their Works for Twelve Months commencing June 1, 1895.

Tenders, to be endorsed "Tar and Liquor," must be delivered at my Office, on or before April 24, 1895.

HUBERT POOLEY, Assoc.M.Inst.C.E.,
Secretary.

Gas-Works, Dunfermline,
April 11, 1895.

DUNFERMLINE GASLIGHT COMPANY, LIMITED.

TENDERS FOR COAL AND CANNEL.

THE Directors of the above Company are prepared to receive TENDERS for the supply of 4700 tons of CANNEL and 3000 tons of COAL suitable for Gas Making for delivery at their Railway Siding, Dunfermline, for One Year from June 1, 1895.

Tenders, to be endorsed "Coals," must be delivered at my Office on or before April 24, 1895.

HUBERT POOLEY, Assoc.M.Inst.C.E.,
Secretary.

Gas-Works, Dunfermline,
April 11, 1895.

SHEFFIELD UNITED GASLIGHT COMPANY.
GRIMESTHORPE STATION.

TO IRONFOUNDERS, ENGINEERS, &c.

THE Directors of this Company invite TENDERS for the construction and erection of a CAST-IRON WATER-TANK, 72 ft. by 36 ft. by 8 ft. deep, with Girders to carry the same, together with FLOOR GIRDERS and other IRONWORK in connection with Block of Buildings comprising Exhauster and Meter Houses, Workshops, Stores, &c., at their Grimesthorpe Station.

Forms of Tender, with Bill of Quantities, may be obtained, and the Drawings seen, upon application to the Engineer, Mr. Fletcher W. Stevenson, on payment of 10s. 6d., which will be returned upon receipt of a *bond-fide* tender.

Sealed tenders, endorsed "Tender for Tank and Ironwork," must be delivered to the undersigned (by post), at the Company's Offices, on or before Monday, the 29th day of April.

The Directors do not bind themselves to accept the lowest or any tender.

HANBURY THOMAS,
General Manager.

Commercial Street, Sheffield,
April 13, 1895.

SHEFFIELD UNITED GASLIGHT COMPANY.
GRIMESTHORPE STATION.

CONTRACT No. 17.

THE Directors of this Company invite TENDERS for the erection and completion, above the present ground level, of a BLOCK OF BUILDINGS, comprising Engine and Exhauster House, Meter-House, Workshops, Stores, &c. The Building is 239 feet long, by 70 feet wide by 25 feet high to Eaves, with Central Water Tower, 59 feet high.

Drawings and Specification may be seen, and Bill of Quantities obtained, upon application to the Engineer, Mr. Fletcher W. Stevenson, on payment of 10s. 6d., which will be returned on receipt of a *bond-fide* tender.

Sealed tenders, endorsed "Tender for New Buildings," must be delivered to the undersigned (by post), at the Company's Offices, on or before Monday, the 29th of April.

The Directors do not bind themselves to accept the lowest or any tender.

HANBURY THOMAS,
General Manager.

Commercial Street, Sheffield,
April 13, 1895.

SHEFFIELD UNITED GASLIGHT COMPANY.
NEEPSEND STATION.

TO IRON ROOF CONTRACTORS, &c.

THE Directors of this Company invite TENDERS for the construction and erection of an IRON ROOF, 210 feet long by 55 feet wide, with Columns and Girders to carry the same, to cover a portion of their Coal Sidings.

Forms of Tender, with Bill of Quantities, may be obtained, and the Drawings may be seen, upon application to the Engineer, Mr. Fletcher W. Stevenson, on payment of 10s. 6d., which will be returned on receipt of a *bond-fide* tender.

Sealed tenders, endorsed "Tender for Iron Roof," must be delivered to the undersigned (by post), at the Company's Offices, on or before Monday, the 29th day of April.

The Directors do not bind themselves to accept the lowest or any tender.

HANBURY THOMAS,
General Manager.

Commercial Street, Sheffield,
April 13, 1895.

ULVERSTON URBAN DISTRICT COUNCIL.

TO TAR DISTILLERS.

THE Gas and Water Committee invite TENDERS for the purchase of the surplus TAR produced at their Gas-Works during the Year commencing the 1st of July next.

Further Particulars and Forms of Tender may be had on application to the undersigned.

Sealed tenders to be sent in not later than the 2nd day of May, addressed to the Chairman of the Gas and Water Committee, and endorsed "Tender for Tar."

The Committee do not bind themselves to accept the highest or any tender.

JNO. SWAN,
Engineer and Manager.

ULVERSTON URBAN DISTRICT COUNCIL.

TENDERS FOR COAL.

THE Gas and Water Committee invite TENDERS for the supply of best screened GAS COAL or COBBLES, for One, Two, or Three Years, commencing the 1st of July next.

Parties tendering must give full particulars of the Coal they propose to supply, and name the Pit from which the same will be raised.

Further Information and Forms of Tender may be obtained on application to the undersigned.

Sealed tenders to be sent in not later than the 2nd day of May, addressed to the Chairman of the Gas and Water Committee, and endorsed "Tender for Coal."

The Committee do not bind themselves to accept the lowest or any tender.

JNO. SWAN,
Engineer and Manager.

TUNBRIDGE WELLS GAS COMPANY.

TO COAL FACTORS AND OTHERS.

THE Directors of the Tunbridge Wells Gas Company will be prepared on Tuesday, the 7th of May next, to receive TENDERS for the supply of 17,000 Tons of either NEW PELTON, NEW TANFIELD, PELAW MAIN, EAST PONTOP, SOUTH HETTON, LONDONDERRY, or other approved GAS COALS, at the option of the Directors, to be delivered free into the Gas Company's Siding, on the South-Eastern Railway at Tunbridge Wells, in accordance with Terms and Conditions, which may be obtained on application.

The tenders are to be sent to me by not later than Six o'clock p.m., on Tuesday, the 7th of May, marked "Tender for Coals."

The lowest or any tender will not necessarily be accepted.

By order,
JOHN READ,
Secretary.

Gas Company's Office,
Tunbridge Wells, April 19, 1895.

GUILDFORD GASLIGHT AND COKE COMPANY.

TO TAR AND LIQUOR DISTILLERS.

THE Directors of the above Company are prepared to receive TENDERS for the surplus TAR and LIQUOR produced by the above Company for the Year ending June 30, 1896.

Coal carbonized, about 10,000 tons per annum.

All tenders to state the price per cask of 40 gallons, and in matter of Liquor to state the price per ounce strength by the distillation test.

Cartage to and from Railway Station, Guildford, free.

All empties to be provided by the Contractor.

Tenders, endorsed "Tar and Liquor," to be sent to Mark Smallpeice, Esq., Chairman of the Gas Company, Guildford, on or before Wednesday, May 8, 1895.

By order,
R. T. SIMPSON,
Secretary.

Gas Offices, Guildford,
April 9, 1895.

GUILDFORD GASLIGHT AND COKE COMPANY.

TO COAL MERCHANTS.

THE Directors of the above Company are prepared to receive TENDERS for the supply of 20,000 to 22,000 tons of GAS COAL, to be delivered free at Guildford Station during the period of Two Years from July 1, 1895, to June 30, 1897, in such quantities and at such times as required.

The Directors reserve the right to accept the whole or any portion of the quantity offered, and do not bind themselves to accept the lowest or any tender.

Tenders, to state the name of the Coal offered, to be endorsed "Tender for Coal," and to be sent to Mark Smallpeice, Esq., Chairman of the Company, Guildford, on or before Wednesday, May 8, 1895.

Cannel need not be tendered for.

By order,
R. T. SIMPSON,
Secretary.

Gas Offices, Guildford,
April 9, 1895.

SCARBOROUGH GAS COMPANY.

TENDERS FOR COAL.

THE Directors of the Scarborough Gas Company are prepared to receive, on or before Noon on Saturday, the 11th day of May next, OFFERS for about 22,000 Tons of high-class COAL, suitable for Gas Making, for delivery in N.E. Railway Company's Waggons, at the Gas-Works Siding, Scarborough, in such monthly quantities as may be required for a period of One, Two, or Three Years, commencing the 1st of July next.

Particulars and printed Forms of Tender may be obtained on application (in writing only) from the undersigned, to whom tenders, duly endorsed "Tender for Coal," must also be addressed.

By order of the Board,
J. HOLLIDAY,
Engineer and Secretary.

Gas Offices: 32, Westborough, Scarborough,
April 19, 1895.

COMMERCIAL GAS COMPANY.

THE Directors of the Commercial Gas Company are prepared to receive TENDERS for the surplus BREEZE produced at their several Works for the Twelve Months ending the 30th of April, 1896.

The quantities are estimated to be as under, but the same cannot be guaranteed, and may be more or less—

At the Stepney Works, in the Regent's Canal.
3300 chaldrons (of 48 bushels) of Fine, and
3300 do. do. of Rough Breeze.

At the Poplar Works, in Bow Creek (free waterway).
3000 chaldrons (of 48 bushels) of Fine, and
3000 do. do. of Rough Breeze.

The tenders may be for the whole or for one or more Works separately.

The Contractors must give security to remove the Breeze as it accumulates, to pay for the same monthly, and generally for the due fulfilment of the contract.

The form of agreement to be signed can be seen at the Company's Offices.

Tenders, sealed and endorsed "Tender for Breeze," to be delivered here not later than the 24th of April inst.

The Directors reserve to themselves the right to accept any tender in part or in whole, and do not bind themselves to accept the highest or any tender.

Commercial Gas-Works, Stepney, E.,
April 10, 1895.

COAL AND CANNEL.

THE Gas Department of the Penrith Urban District Council are prepared to receive TENDERS for the supply of COAL and CANNEL during the Year ending June 30, 1896.

Tenders, endorsed "Tender for Coal," to be delivered to Mr. J. Wainwright, Public Offices, Penrith, not later than the 4th of May prox.

Further Particulars may be obtained from the undersigned.

E. SHAUL,
Manager.

Gas-Works, Penrith,
April 20, 1895.

BOROUGH OF BRIGHOUSE.

TENDERS FOR COAL AND LIME.

THE Gas Committee are prepared to receive TENDERS for the supply and delivery of GAS COAL and BUXTON LIME required at the Brighouse Gas-Works during the Year ending June 30, 1896.

Specification and Form of Tender can be obtained on application at the Gas Engineer's Office, Public Offices, Brighouse.

Sealed tenders, stating price per ton delivered at the Gas-Works, or alongside the Gas-Works by the Calder and Hebble Canal, or at the Brighouse Railway Station, must be sent in on or before Saturday, the 4th day of May, 1895, addressed to the Town Clerk, Public Offices, Brighouse, endorsed on the outside "Tender for Coal" or "Lime," as the case may be.

The lowest or any tender not necessarily accepted.

By order,
JAMES PARKINSON,
Town Clerk.

Public Offices, Brighouse,
April 17, 1895.

LURGAN GAS, LIGHT, AND CHEMICAL COMPANY, LIMITED.

COAL WANTED.

THE Directors invite Tenders for the supply of 2750 tons of best screened GAS COAL, delivered into Lighters *ex*-ship at Belfast, free of all Charges.

Delivery of 2000 tons will be taken before the 1st of November next; the remainder to be delivered at such times before the 1st of April, 1896, as may be required.

Vessels carrying from 200 to 300 tons can at once deliver into Lighters, and these Lighters be back for a further cargo within a period to be arranged and agreed upon by the Gas Company.

Tenders (in sealed envelope), accompanied by reference to Gas-Works using the Coal offered, should reach me not later than Ten o'clock in the forenoon of Monday, the 6th of May next.

The Directors do not bind themselves to accept the lowest or any tender.

FRED. W. MAGAHAN,
Secretary.

Gas-Works, Lurgan,
May 10, 1895.

TO BE SOLD by Tender, pursuant to an order of Mr. Justice Kekewich, made in an action, *Pasley v. The Wenham Company, Limited*, 1893, p. 3082, and dated the 11th of December, 1894, in one or more lots, the EXTENSIVE AND WELL-KNOWN BUSINESS OF LAMP MANUFACTURERS, GAS-FITTERS, AND STOVE MAKERS, carried on for many years by the Wenham Company, Limited, and their Predecessors, and now being carried on by the Receiver and Manager, and the various PATENTS for the United Kingdom and other Countries, STOCK-IN-TRADE, MACHINERY, PLANT, FIXTURES, and UTENSILS, and the LEASEHOLD PREMISES in Upper Ogle Street, Fitzroy Square, London, and Rue Couston, Paris.

Tenders for the whole Property, in one lot or more lots, must be sent in, under cover, to Mr. Ernest Cooper (Messrs. Cooper Bros.), 14, George Street, Mansion House, London, E.C., not later than the 11th day of May, 1895; and on the 15th day of May, 1895, at Twelve o'clock at Noon, the Chief Clerk of the said Judge will declare who is or are the purchaser or purchasers.

Particulars and Conditions of Sale and Form of Tender, and Particulars of the Plant and Stock-in-Trade may be obtained gratis on application to the said Messrs. Cooper Bros. & Co., 14, George Street, Mansion House, E.C.; Messrs. Farebrother, Ellis, Clark, & Co., Surveyors and Auctioneers, 29, Fleet Street, Temple Bar, or 18, Old Broad Street, E.C.; Messrs. Clarke, Rawlins, & Co., 66, Gresham House, Old Broad Street, E.C., Solicitors; and to Messrs. Drake, Son, & Parton, 24, Rood Lane, E.C., Plaintiff's Solicitors.

Dated this 10th day of April, 1895.

RICHARD JOHN VILLIERS,
Chief Clerk.

THE Directors of the Shotley Bridge and Consett District Gas Company are prepared to receive TENDERS for the provision, fixing, and completing of IRON WORK, consisting of Hydraulic Main, Ascension-Pipes, Mouthpieces, Furnace Doors and Frames, required in two Beds of Retorts—32 Mouthpieces.

Plans and Specifications may be seen at the Company's Offices.

Tenders to be sent in not later than the 30th inst.

M. RICHLEY,
Secretary.

AYLSHAM GAS COMPANY, LIMITED.

TENDERS are invited from Colliery Proprietors for the Year's supply of COALS (from 250 to 300 tons), to be delivered in such quantities as ordered, at the Aylsham Town Station (Midland and Great Northern Railway).

Tenders to state Particulars of Coal, and a sample Truck to be sent if required.

HENRY J. GIDNEY,
Secretary.

Aylsham, Norfolk,
April 19, 1895.

TO ENGINEERS AND CONTRACTORS.

THE Directors of the Oundle Gas Com- pany are prepared to receive TENDERS for an IRON ROOF, one PURIFIER, a SCRUBBER, &c., and REMOVING and RE-ERECTING certain APPARATUS and PIPES at their Works at Oundle.

Plans and Specifications may be seen on application to the Secretary of the Company at Oundle, or to Mr. John Eunson, C.E., Northampton, on or after Monday, April 22.

Tenders, addressed to the Chairman, to be delivered to the Secretary of the Gas Company on or before Monday, April 29.

The Directors do not bind themselves to accept the lowest or any tender.

ROBERT KNIGHT,
Secretary.

Oundle, April 13, 1895.

TENDERS FOR GAS COAL.

THE Brentwood Gas and Coke Company invite TENDERS for the supply of about 4000 tons of screened GAS COAL in Trucks at Brentwood Railway Station (G.E.R.), at per ton, to be delivered in the following quantities the second week of each month: June, 140 tons; July, 160 tons; August, 200 tons; September, 400 tons; October, 450 tons; November, 500 tons; December, 560 tons; January, 500 tons; February, 350 tons; March, 300 tons; April, 250 tons; May, 190 tons.

Tenders (with Analysis of the Coal to be supplied), and Terms for monthly payments, to be sent to the undersigned, on or before the 30th inst.

The Directors do not bind themselves to accept the lowest or any tender.

C. A. FIELDER,
Secretary.

Brentwood, Essex,
April 13, 1895.

CONSETT WATER-WORKS.
CONTRACT No. 1.

THE Directors of the Consett Water- Works Company are prepared to receive TENDERS for the construction of Four Covered FILTER-BEDS (each 125 feet long by 80 feet wide), a PURE-WATER TANK, Two COTTAGES, and other WORKS connected therewith, to be constructed on the Property of the Company at Honey Hill, in the Parish of Muggleswick, in the County of Durham, and situate about 4 miles from Consett and about 1 mile from Waskerley.

Drawings may be inspected, and Specification and Form of Tender and Schedule of Quantities may be obtained (on payment of Two Guineas, returnable if a *bonâ-fide* tender be made), on application at the Office of the Company at Consett, and at the Office of Messrs. T. & C. Hawksley, Civil Engineers, 30, Great George Street, Westminster, S.W., on and after Tuesday, the 23rd of April; and tenders must be delivered at the Water-Works Office, Consett, at or before Noon on Wednesday, the 8th of May next.

The Company do not pledge themselves to accept the lowest or other tender.

By order,
ALEXANDER RUSSELL, jun.,
Secretary.

Consett, April 9, 1895.

MERTHYR TYDFIL GAS COMPANY.

TENDERS FOR COAL.
TO COLLIERY PROPRIETORS.

THE Directors of the Merthyr Tydfil Gas Company require TENDERS for the supply, for Three or Five Years, at the option of the Seller, of about 6000 Tons per Annum (or such other quantity as may be agreed upon) of the BEST QUALITY LARGE SCREENED GAS COAL, to be delivered on their Railway Siding (Taff Vale Railway), Gas-Works, Picton Street, Merthyr Tydfil, in such quantities as the Manager may from time to time require during a period commencing on the 1st of July next.

Payments will be made by net cash monthly for previous month's deliveries.

Further Particulars, with Specification and Form of Tender, may be obtained on application to the undersigned.

Tenders must be on the Company's printed form, otherwise they will not be considered; and the tender, sealed and endorsed "Coal," specifying the description of Coal, and the Pit at which it is to be raised, must be addressed to E. B. Evans, Esq., J.P., the Chairman of the Directors, and left at the Gas Offices, Merthyr Tydfil, not later than Ten o'clock a.m., on Monday, the 6th of May prox.

The Directors do not bind themselves to accept the lowest or any tender.

By order of the Board of Directors,
JOHN L. COCKER,
Manager and Secretary.

Gas Offices, Gas-Works,
Merthyr Tydfil, Glamorganshire,
April 15, 1895.

BOROUGH OF BARROW-IN-FURNESS.

SUPPLY OF COAL AND CANNEL.

THE Corporation are prepared to receive TENDERS, on forms to be obtained at the Office of the Gas-Works Manager, for the supply of screened GAS COAL and CANNEL for the Year ending the 30th of June, 1896.

Tenders, addressed to the Chairman of the Gas and Water Committee, and endorsed "Tender for Coal," to be delivered, at the Town Clerk's Office, not later than Twelve o'clock Noon on Wednesday, the 1st day of May, 1895.

The lowest or any tender not necessarily accepted.

By order,
C. F. PRESTON,
Town Clerk.

Town Hall, Barrow-in-Furness,
April 18, 1895.

BROMLEY GAS CONSUMERS' COMPANY.

NOTICE is Hereby Given, that an Ex- TRAORDINARY GENERAL MEETING of this Company will be held at the Bell Hotel, Bromley, Kent, on Thursday, the 25th day of April, 1895, at Six o'clock precisely, at which a Resolution will be submitted authorizing the Directors, under the Provisions of the Bromley Gas Act, 1879, to raise the whole of the money which the Company have already raised, or are authorized to raise, on Mortgage, by the creation and issue at such times, in such amounts and manner, on such terms, subject to such conditions, and with such rights and privileges, as the Directors for the time being may think fit, of Stock, to be called Debenture Stock, instead of such money so already raised, or authorized to be raised by Mortgage; such stock to bear a Perpetual Preferential Interest of £3 10s. per cent. per annum, payable half yearly, commencing from the date of the issue from time to time of such Debenture Stock.

By order,
H. W. AMOS,
Secretary.

Gas-Works, Bromley, Kent,
April 9, 1895.

By order of the Executors of the late Mr. George Garnett,

GAS AND WATER AND OTHER STOCKS AND SHARES.

MR. ALFRED RICHARDS will Sell by AUCTION, at the Mart, Tokenhouse Yard, E.C., on Tuesday, May 7, 1895, at One for Two o'clock precisely, in lots—

BARNET DISTRICT GAS AND WATER COMPANY—£40 "A" STOCK, £460 "C" STOCK, £90 "D" WATER STOCK, and three 4 per cent. MORTGAGE BONDS of £800, £200, and £200 each.

EDWARD COCKEY AND SONS, LIMITED.—Ten £10 fully-paid SHARES, and four 5 per cent. DEBENTURE BONDS of £25 each.

THE GAS-METER COMPANY, LIMITED.—Twenty £10 fully-paid SHARES.

Particulars of J. W. FARDELL, Esq., Solicitor, Market Street, RYDE, I.W.; of Messrs. FARDELL AND CANNING, Solicitors, Mitre Chambers, TEMPLE; of Messrs. ALFRED LASS, WOOD, AND CO., Accountants, 30, GRACECHURCH STREET, E.C.; of Mr. ALFRED RICHARDS, Auctioneer, 18, FINSBURY CIRCUS, E.C., and 816, High Road, TOTTENHAM.

By order of the Executors of the late Mr. George Garnett.

RYDE, ISLE OF WIGHT.

TO CAPITALISTS, INVESTORS, AND OTHERS.

MESSRS. COOMBES have received Instructions to SELL by AUCTION at the Auction Mart, Cross Street, Ryde, on Friday, April 26, 1895, at Six o'clock in the Evening punctually, in lots, the following VALUABLE SHARES AND STOCK:—

123 ORIGINAL SHARES of £12 10s. each (fully paid up); 85 ORDINARY SHARES of £12 10s. each (fully paid up); 19 ORDINARY SHARES of £12 10s. each, of which sum £2 10s. per Share has been paid, in the RYDE GASLIGHT COMPANY.

£1030 CONSOLIDATED ORIGINAL CAPITAL STOCK, and £1000 MORTGAGE DEBENTURES in the RYDE PIER COMPANY.

Particulars and Conditions of Sale may be obtained of the AUCTIONEERS, at their Auction and Estate Agency Offices, RYDE, and of JOHN WILSON FARDELL, Esq., Solicitor, RYDE.

By order of the Executors of the late Mr. George Garnett.

RYDE, ISLE OF WIGHT.

TO CAPITALISTS, INVESTORS, AND OTHERS.

MESSRS. COOMBES are favoured with Instructions to SELL BY AUCTION at the Auction Mart, Cross Street, Ryde, on Wednesday, May 1, 1895, at Six o'clock in the Evening, the following VALUABLE SHARES, in lots:—

108 £5 ORIGINAL SHARES, fully paid, and 32 ORDINARY SHARES, of the same value, in the SHANKLIN GAS COMPANY, LIMITED.

Ten £20 ORIGINAL SHARES, fully paid, and ten Additional CAPITAL SHARES, of the same value, in the VENTNOR GAS AND WATER COMPANY.

Six £25 SHARES, Ordinary Stock, fully paid, four £25 PREFERENCE SHARES, fully paid, and two DITTO, £20 paid, in the GOSPORT GAS AND COKE COMPANY.

Six £50 SHARES, "B" Series, fully paid; six £50 SHARES, "C" Series, fully paid, and £7 5s. 10d. STOCK in the PORTSEA ISLAND GASLIGHT COMPANY.

Five £10 ORIGINAL SHARES, fully paid, 45 £5 NEW SHARES (1868 Series), fully paid, and 13 £5 NEW ORDINARY CAPITAL SHARES (1879 Series), fully paid, and 34 DITTO of £5 each (1883 Series), £4 paid, in the BOROUGH OF PORTSMOUTH WATER-WORKS COMPANY.

Particulars and Conditions of Sale may be obtained of the AUCTIONEERS, at their Auction and Estate Agency Offices, RYDE, and of JOHN WILSON FARDELL, Esq., Solicitor, RYDE.

GEORGETOWN (BRITISH GUIANA) GAS COMPANY, LIMITED.

NOTICE is Hereby Given, that the ORDINARY HALF-YEARLY GENERAL MEETING of the Shareholders of the above Company will be held at the Offices of the Company, 30, Gracechurch Street, in the City of London, on Tuesday, the 14th day of May next, at Three o'clock in the Afternoon precisely, to receive the Directors' Report and the Accounts of the Company for the Half Year ended the 31st day of December last, to declare a Dividend, to elect Directors and an Auditor in place of those retiring by rotation, and to transact the General Business of the Company.

The TRANSFER BOOKS WILL BE CLOSED from the 1st to the 14th of May next, both inclusive.

By order of the Board,
SAMUEL WOOD,
Secretary.

Offices: 30, Gracechurch Street,
London, April 16, 1895.

NOTICE.

TO GAS ENGINEERS AND OTHERS.

MESSRS. CLAPHAM BROS., Limited, Keighley, Yorkshire, are no longer authorized to Manufacture my CONDENSER and WASHER-SCRUBBERS.

The above-named Gas Apparatus are erected and giving entire satisfaction at the following places: Neath, Lincoln, Sheffield, Ellesmere, Mountain Ash, Malden, Cullingworth, Montreal (Canada), Woodstock (South Africa), Cape Town (South Africa), &c.

These Appliances can now be obtained solely of the undersigned.

Winchester House, London, E.C. J. A. KELMAN.

NOTICES FOR POSTING IN GAS-WORKS.

CARDS suitable for Exhibiting in Gas- Works, directing Officers and Workmen to REPORT all ACCIDENTS witnessed by them, together with the Clause of the "NOTICE OF ACCIDENTS ACT, 1894," specifying the notice required to be sent to the Board of Trade, can be obtained, *price 4d. each, or 2s. 6d. per dozen, post free.*

Section 4 of the "CONSPIRACY AND PROTECTION OF PROPERTY ACT, 1875," has been similarly printed. It is required, under a Penalty of FIVE POUNDS, that a Copy of the Section shall be posted up at all Gas-Works, in a conspicuous place, where the same may be conveniently read by persons employed thereat. Copies, in large type, on broad sheets (22½ inches by 17½ inches) may be obtained of WALTER KING, 11, Bolt Court, FLEET STREET, E.C. *Price 2s. per dozen;* 10s. 6d. *per* 100. On Cards the same size as those relating to the "Notice of Accidents Act," *price 4d. each or 2s. 6d. per dozen.*

Price 6s., Cloth Bound,

THE CHEMISTRY OF ILLUMINATING GAS,

By

NORTON H. HUMPHRYS, Assoc. M.Inst.C.E., F.C.S.

This work contains chapters on: The Relative Cost of Light from Gas, Oil, and Candles; Products of Combustion; The Sulphur Question; The Composition of Illuminating Gas; Water Gas; Various Gas-Making Processes; Oil Gas; Properties of Fluid Hydrocarbons; Tar for Gas-Making; Destructive Distillation; Condensation; and Purification.

LONDON: Walter King, 11, Bolt Court, Fleet St., E.C.

HARCOURT'S COLOUR TEST.

For Carbon Bisulphide, Sulphuretted Hydrogen, and Carbonic Acid in Coal Gas.

The Materials for the above Tests may be obtained from

Mr. S. E. MILLER, 115, Cowley Road, Oxford.

HUNTER'S

OXIDE OF IRON.

JAMES HUNTER, MINER, AND SHIPPER OF NATURAL IRISH BOG ORE.

This Estate yields the finest and most uniform quality in Ireland; and the quality is guaranteed.

Samples and Prices on application.

11, BAY STREET, PORT GLASGOW.

Telegrams: "HUNTER, PORT GLASGOW."
Established 1872.

LOW MOOR BLACK BED

GAS COAL.

YIELD OF GAS PER TON . 10,375 CUBIC FEET.
ILLUMINATING POWER . 17·50 SPERM CANDLES.
COKE . . . . . 75 PER CENT.

Prices, f.o.r. or f.o.b., on application to

GEORGE & JOHN HAIGH,

RAVENS LODGE AND CONYERS' COLLIERIES,

DEWSBURY.

A TRIAL IS RESPECTFULLY SOLICITED.

HOLMSIDE GAS COALS.

PRESENT DAILY PRODUCE OVER 4000 TONS.

LATEST ANALYSIS:—

Yield of Gas Per Ton . . 11,205 Cubic Feet.
Illuminating Power, 16 7/10 Stand. Sperm. Candl.
Coke (of good & pure quality) 13¾ Cwt. Per Ton.
Sulphur . . . . A little over 1 Per Cent.
Ash . . . . . Under 1 Per Cent.
Tar . . . . . 163 Lbs. (Avoir.) Per Ton.
Ammoniacal Liquor 103 Lbs. (Avoir.) Per Ton.

HOLMSIDE GAS COALS are supplied to the largest Gas Companies in England and on the European Continent; London alone consuming about half the produce.

SOUTH MOOR PELTON GAS COALS.

PRESENT DAILY PRODUCE AVAILABLE, 2500 TONS.

RESULTS OF DIFFERENT ANALYSES:—

Yield of Gas Per Ton . . 10,500 Cubic Feet.
Illuminating Power . 17 Stand. Sperm Candl.
Coke (of excellent quality) . 13½ Cwt. Per Ton.
Sulphur . . . . . 1·13 Per Cent.
Ash. . . . . 1·34 Per Cent.
Tar . . . . . 180 Lbs. (Avoir.) Per Ton.
Ammoniacal Liquor 94½ Lbs. (Avoir.) Per Ton.

The HOLMSIDE and SOUTH MOOR COAL-FIELD possesses *a very great quantity of the best Coal;* and, whilst other Coal-Fields are becoming exhausted, this one is only being opened out, so that *the quality* of both the HOLMSIDE COALS, and the SOUTH MOOR COALS *may be relied upon for all practical purposes.*

These Coals may be bought through the Principal Merchants in England, or direct from

MR. MARK ARCHER,
HOLMSIDE AND SOUTH MOOR OFFICES,
NEWCASTLE-UPON-TYNE.

LONDONDERRY GAS COALS

FROM THE

MARQUIS OF LONDONDERRY'S COLLIERIES,
COUNTY OF DURHAM.

Available output up to 5000 tons per day.
Yield of Gas 11,000 cubic feet per ton of Coal as per analysis by Mr. John Pattinson, F.C.S., F.I.S.

FOR PRICES AND PARTICULARS, APPLY TO

S. J. DITCHFIELD,
SEAHAM HARBOUR, COUNTY OF DURHAM.

ALFRED WILLIAMS & Co.

(MATTHEW MILDRED)

71, 72 & 73, BANKSIDE, SOUTHWARK, S.E.

UNIVERSAL PROVIDERS FOR GAS, WATER, & SEWAGE WORKS.

ENGINEERS & CONTRACTORS

FOR THE ERECTION OF COMPLETE GAS AND WATER WORKS, AND FOR RENEWALS AND EXTENSIONS OF EVERY DESCRIPTION.

PLANS & ESTIMATES ON APPLICATION.

MAIN LAYING AND RETORT SETTING.

HEBBURN MAIN GAS COALS.

Yield of Gas per ton . . . . . 10,500 cub. ft.
Illuminating Power . . . . . 16·4 candles.
Coke . . . . . 68 per cent.

For prices, f.o.b. Ship or Delivered by Rail, apply to

THE WALLSEND & HEBBURN COAL COMPANY, LTD.,
B Lombard Street,
NEWCASTLE-ON-TYNE.
W. RICHARDSON, Fitter.

BOLDON GAS COALS.

Worked by THE HARTON COAL CO., LTD.
Output about 3000 tons per day.

ANALYSIS—

Yield of Gas per ton . .	10,500	Cubic Feet.
Illuminating Power . .	16·9	Candles.
Coke	66·7	Coke.
Sulphur	0·86	Sulphur.
Ash	2·04	Ash.

Boldon Gas Coals are supplied under contract to

The Gaslight and Coke Company, South Metropolitan Gas Company, Imperial Continental Gas Association, European Gas Company, L'Union des Gaz (the Continental Union Gas Company), Crystal Palace District Gas Company, Bombay Gas Company, San Paulo Gas Company, Ipswich Gaslight Company, Newcastle Gas Company, Sunderland Gas Company, South Shields Gas Company, and to many other Companies at Home and Abroad.

For prices, &c., apply to the

HARTON COAL COMPANY,
LIMITED,
Newcastle-on-Tyne.
W. H. PARKINSON,
FITTER.

THE NATIONAL.

Absolutely the Best Slot-Meter Obtainable.

GUARANTEED FOR 5 YEARS.

Telegraphic Address: "Stidder," London. **Telephone Number, 4843.**

Takes **PENNIES** and **HALFPENNIES** in the same slot, and supplies proportionate quantities of gas.

The coin-receiving mechanism is immensely strong, and so separated from the registering mechanism, that it is impossible to damage either, even with the most careless usage.

THE NATIONAL.

Will take a number of pennies, but cannot be jambed by the insertion of a second coin until the first is discharged.

Is compact and handsome; cannot be tampered with by any amount of ingenuity; whilst its mechanism is the simplest and strongest in the market.

Price changeable *in situ.*

WE INVITE YOU TO TEST THIS METER IN COMPETITION WITH OTHERS.

THE NATIONAL METER COMPANY, LIMITED,

OFFICE AND WORKS:

AQUINAS ST., STAMFORD ST., LONDON, S.E.

LABORLESS WORK
In 1895.

ENGINEERS AND MANAGERS

Making preparations to adopt

SELF-ACTING SYSTEMS OF CARBONIZING

In 1895,

are cordially invited to call and inspect our latest Designs of Automatic Coal and Coke Handling and Charging Machinery.

We send skilled Draughtsmen to get Particulars for Detail Plans.

Address:—

NEW CONVEYOR CO., LTD.,
3 & 4, Lime Street Square, London, E.C.

KENT'S THICK GAS COAL
RAISED AT
The Wharncliffe Woodmoor Colliery,
BARNSLEY.

Yield of Gas, nearly 12,000 *Cubic Feet per ton of Coal; and Illuminating Power nearly* 17½ *Candles.*

The following is a complete ANALYSIS made by Mr. R. O. PATERSON, C.E., Gas-Works, Cheltenham:—

Specific Gravity (Water 1)	1·276
Weight of One Cubic Foot	79·700 lbs.

PROXIMATE ANALYSIS.

Moisture in Coal	2·68 per cent.
Volatile Matter	35·60 ,,
Fixed Carbon	58·80 ,,
Sulphur	0·96 ,,
Ash	1·96 ,,

COMMERCIAL ANALYSIS.

Gas per Ton of Coal	11,760 cub. feet.
Gas per Cubic Foot of Coal	418 ,,
Illuminating Power	17·44 candles.
Value of One Cubic Foot in Sperm	418 grains.
Value per Ton of Coal in Sperm	703 lbs.
Coke per Ton of Coal	1367 ,,
Coke	61·05 per cent.
Ash in Coke	3·21 ,,
Sulphur Eliminated with Volatile Products per Ton of Coal	9·4 lbs.
Sulphur in Coke per Ton of Coal	12 ,,
Ammoniacal Liquor per Ton of Coal	19·7 galls.
Tar per Ton of Coal	12·2 ,,

R. O. PATERSON, C.E.

Gas-Works, Cheltenham,
8th August, 1894.

For Price, &c., apply to the
Wharncliffe Woodmoor Colliery Co
LIMITED,
BARNSLEY;
Or to **Mr. W. H. HARVEY,**
17, Old Queen Street, Westminster, S.W.

TO EMPLOYERS, COMPANY DIRECTORS, ETC.

The LAW GUARANTEE & TRUST SOCIETY,
LIMITED,
GUARANTEES FIDELITY.
Send for complete Prospectus, containing Balance-Sheet, Copy of Policy, &c., &c.

HEAD OFFICE:
49, CHANCERY LANE, LONDON, W.C.

UNEQUALLED.
Gas Companies are solicited to try Samples of the
MIRFIELD
BLACK BED GAS COAL.
Prices and Analysis on application.
MIRFIELD (GAS-COAL) COLLIERY COMPY.
RAVENSTHORPE, NEAR DEWSBURY.

Awarded HIGHEST MEDAL and DIPLOMA at the Newcastle-on-Tyne Royal Mining and Industrial Exhibition, 1887, for

CANNEL & COAL.

TYNE
BOGHEAD CANNEL.

Yield of Gas per ton	13,155 cub. ft.
Illuminating Power	38·22 candles.
Coke per ton	1,301·88 lbs.

EAST PONTOP GAS COAL.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	16·3 candles.
Coke	70 per cent.

SOUTH PELAW MAIN GAS COAL.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	16·3 candles.
Coke	73·1 per cent.

For Prices and complete Analysis, apply to
THOS. W. DANCE & SONS,
Coal Owners, Newcastle-on-Tyne;
OR
E. FOSTER & CO.,
21, John Street, Adelphi, London, W.C.

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	Per Cent.
Carbon	83·128
Hydrogen	5·116
Oxygen	7·401
Nitrogen	0·585
Sulphur	0·620
Ash	3·130
Water	0·020
	100·000

Analysis of the Coke.

Carbon	93·31
Sulphur	0·61
Ash	5·00
Moisture	1·08
	100·00

I am, Gentlemen,
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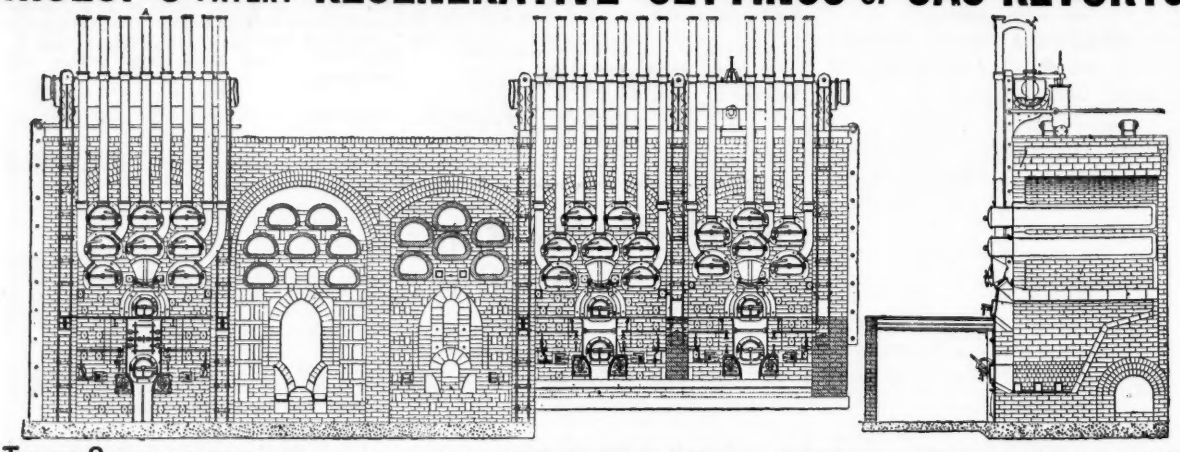
ANALYSES AND PRICES ON APPLICATION.

HISLOP'S PATENT REGENERATIVE SETTINGS OF GAS-RETORTS.



THESE SETTINGS ARE POSITIVELY UNRIVALLED IN PRODUCTIVE CAPACITY, DURABILITY, AND SIMPLICITY OF MANAGEMENT. RETORTS OF ORDINARY DIMENSIONS, CARBONIZING FROM 18 TO 24 CWT. OF ENGLISH AND 21 TO 26 CWT. OF SCOTCH COAL PER 24 HOURS, DEPENDING UPON THE NATURE OF THE COAL, AND PRODUCING UP TO FULLY 13,000 CUBIC FEET PER MOUTHPIECE IN THE SAME TIME, AND WITH THE SMALLEST EXPENDITURE OF FUEL ATTAINABLE, AND RETURNING IN PROFIT THE ENTIRE COST OF ERECTION WITHIN TWELVE TO EIGHTEEN MONTHS; AND THUS REDUCING TO INSIGNIFICANCE THE INCREASED COST OF THESE SETTINGS OVER THE COMMON OR GENERATOR FURNACE SYSTEMS.

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Drawings and Tenders are furnished for the complete erection of Benches, including Retort and Bench Mounting of the most modern and approved description; or existing Ovens fitted up with the Patentee's arrangements.

Full Particulars may be had on application to the Patentee's Agents: **Messrs. JONAS DRAKE AND SON**, Retort Setters and General Carbonizing Engineers, Ovenden, Halifax, Yorkshire, Sole Agents for England, Wales, and Foreign Countries; **C. M. HAMILTON**, Retort Setter and Contractor, 5, Stuart Street, Shawlands, Glasgow, Agent for Scotland and Ireland; and to the Principal Agent, **R. F. HISLOP** (Son of Patentee), General Constructing and Carbonizing Engineer, Gas-Works, Paisley, N.B.

HISLOP'S PATENT HYDRAULIC MAIN SEAL-REGULATING AND TAR-EXTRACTING VALVE is a *Sine qua non* TO THE SATISFACTORY WORKING OF THE HYDRAULIC MAIN UNDER THE REGENERATIVE AS WELL AS OTHER SYSTEMS OF RETORTS. BEING LARGELY ADOPTED AND AFFORDING THE HIGHEST SATISFACTION.

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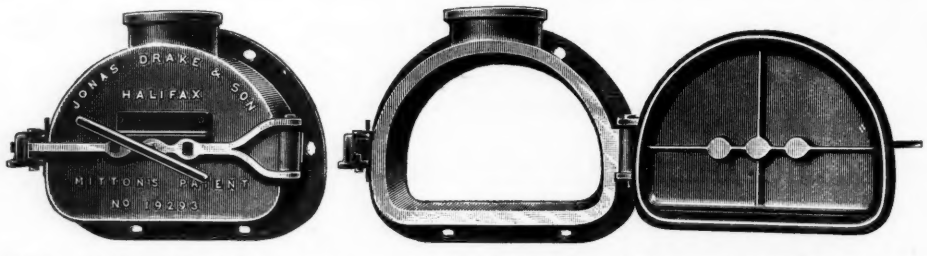

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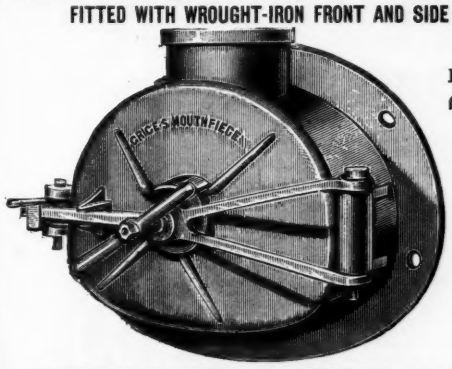

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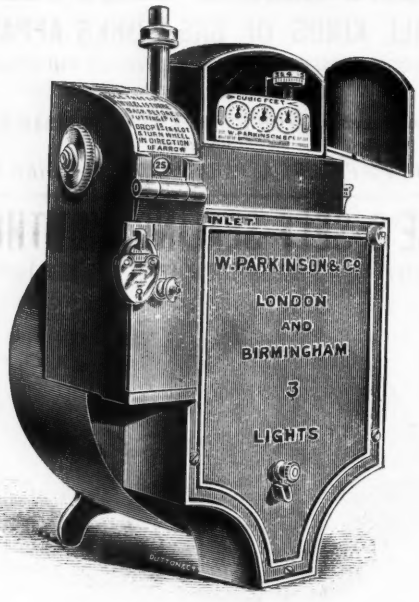

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See also Advt. p. 834.

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